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Cabinet Saw.

The accompanying illustration represents a cabinet saw specially designed for cutting and squaring up stereotype plates or plates for photo-process engravings; it will cut blocked as well as unblocked plates.

The mandrel for the saw is made of steel, and works in self-oiling bearings which are rigidly supported by a heavy cast-iron frame. The mandrel is made strong enough for a saw 8 inches diameter, but for the average work, even for mounted plates, a 6-inch saw is sufficient, and for unblocked plates a still smaller one is desirable.

The cast-iron table top of the machine is 28½x37 inches, and is attached to the front of the machines by hinges. On these hinges the top may be raised for the purpose of changing saws, throat-pieces, etc. By means of the hand-wheel and worm-gearing, shown on the right-hand side of the machine, the top may be raised or lowered to suit the requirements of the work to be cut. Frequent use of this wheel should be made, so as not to allow the saw, while cutting, to protrude through the work any further than is absolutely necessary. By a universal adjustment of the hinges the table may be made to conform to the wear of the mandrel in its bearings, thereby securing at all times a practically perfect alignment with the saw, both horizontally and vertically, and also maintaining great accuracy between it and the gauges.

The top is provided with conveniently arranged ripping and cross-cutting gauges, which are accurately fitted into beveled grooves planed in the top, thereby insuring accuracy in sawing. The ripping gauge can be removed. It is provided with an adjustable iron fence, in which is arranged a convenient detachable device for securing gauges of various shapes and for special work.

The construction of the throat-piece of this machine is very simple, and it may, at the will of the sawyer, be renewed in a comparatively short time. It is firmly secured to its place while in use, but can be readily removed when necessary. This arrangement enables the sawyer to have the opening in the throat-piece very close to the saw, which at times is an item of great importance.

For convenience, and also for the purpose of promoting the general usefulness of the machine, it is provided with an ample dust drawer, a tool closet, a removable shelf, and an adjustable chip guard for carrying a glass plate; all these are plainly shown in the illustration.

The machine is driven by a four-inch belt running over a 2¼-inch pulley on the mandrel, and over an 18-inch pulley on the countershaft which is furnished with the machine. The countershaft should make 500 revolutions per minute, which will give the saw 4,000 revolutions per minute. It is important that the belt be uniform in thickness throughout its entire length, the laps included. Rivets or lacings should not be used, but the laps may be sewed lengthwise with waxed shoemakers' thread. In order to take up any slackness in the belt, the machine should be moved on the floor.

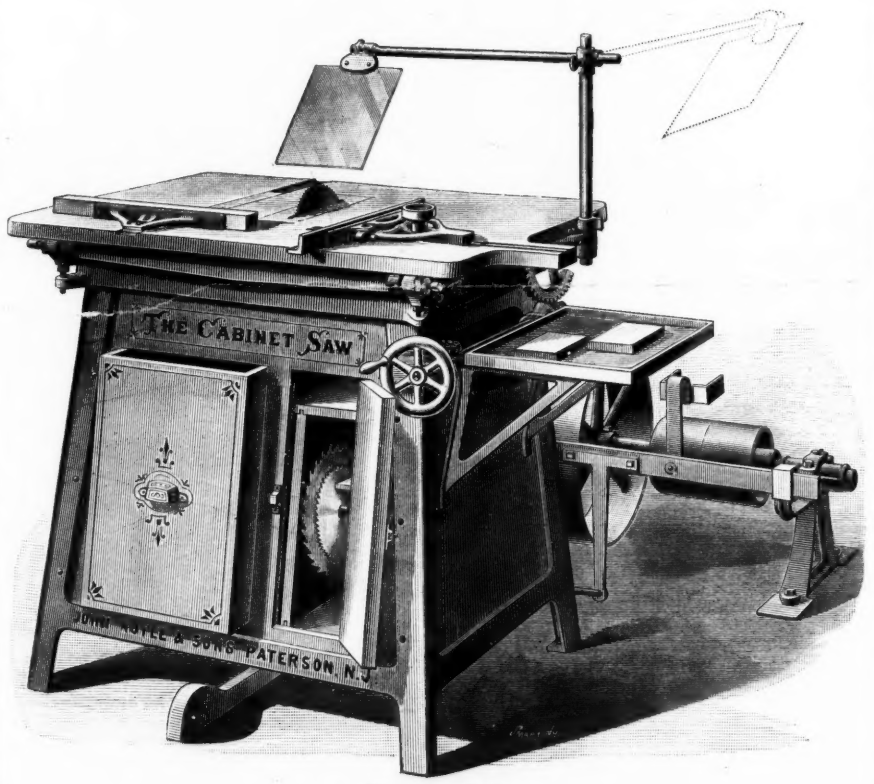
Floor space of the machine is 4x6 feet; weight, 350 pounds; size of saws, 4 to 8 inches.

An inspection of the engraving will show this to be a very compact tool, and we believe it to be well designed for the purposes for which it is intended. It is made by John Royle & Sons, Paterson, N. J.

Dust Explosions.

BY PROF. DE VOLSON WOOD.

The explosions to which we will refer in this article are the result of a rapid combustion. As a result of such combustion, confined gases are in some cases suddenly set free, and act with great violence, and in other cases the combustion suddenly heats the air, causing it to expand suddenly and with such force as to produce disastrous results. All combustion is, in a certain sense, an explosion; but in a popular sense it is confined to those cases in which the action is so sudden as to occupy no appreciable time. It is known that if gunpowder be wet, it will burn so slowly as not to explode, and between that condition and the condition of thorough dryness there will be corresponding grades of quickness in the burning.



CABINET SAW.

Some substances which, in their ordinary condition, will burn very slowly, may explode when dry and very finely pulverized. We will note a few cases of these, known as dust explosions.

A few years since, there was an explosion in a candy store on the north side of Barclay street, in this city, which so injured the building as to cause it to be vacated, and injured several persons. It occurred a few days before Christmas, and two or three minutes after the 4.10 ferryboat left its slip. It took place in the second or third story, where the business was going on as on previous days, and where no explosives were kept. A coroner's jury failed to detect even a malicious act on the part of any person. It is quite certain that this explosion was the result of the rapid combustion of the very fine particles of sugar and other ingredients used in the manufacture of candy, which were floating in the air. Being just before the holidays, the business was pushed with great vigor, and the room, especially in the latter part of the day, became thoroughly filled with this fine dust, and at the time of lighting the gas it took fire, and suddenly—almost instantly—burned, heating the air and expanding it so suddenly as to demolish some of the walls, and produced a flame that was seen for a great distance. It was a veritable explosion.

A flouring mill at Minneapolis was destroyed a few years since by an explosion resulting from the sudden burning of the flour-dust which filled the building. It took fire from a lamp in the hands of an attendant. In this case the stone walls were thrown down, and the mill became a heap of ruins.

Not long since, a mechanic ascended a ladder to adjust a pulley. He brushed off the dust from the top of a beam where it had accumulated to a considerable amount; it took fire and exploded with such violence as to cause the death of the workman.

In a certain wood-working establishment, which produced large quantities of very fine wood-dust, the dust once caught fire at the furnace door, and exploded with such violence as to destroy a portion of the walls of the building.

It is not improbable that some explosions in coal mines have been due to this cause, which have been attributed to fire damp—the dust having been finely pulverized coal.

These explosions may be avoided by forced and thorough ventilation, so that the quantity of dust in a given space shall be very small. In the case of the mechanic referred to above, the explosion would have been avoided by the use of a properly constructed lamp. In flouring mills and in wood-working manufactories, the dust is in many cases drawn from the working rooms by means of fans, and forced into a close room, where it is under the control of the superintendent. In some large establishments the dust so gathered is used as fuel, by being fed to the furnace by means of properly constructed devices—similar in principle to those used for feeding liquid fuel to a furnace.

The Piece-Work Question.

BY JOHN T. HAWKINS.

The piece-work question, as descanted upon by Mr. Joshua Rose in your issue of the 21st, is an interesting one, and as old as interesting. It has always appeared to me, however, that pretty much every attempt made to get at a solution of it takes the form of—to use a well-worn phrase—whipping the devil around the stump. Mr. Rose says, in effect, and perhaps truly, that workmen object to the piece-work system from a fear that in the end they will be obliged to produce the same amount for less money, or more work for the same pay, or that, no matter how great their production may become, the regulation day-wages will eventually not be exceeded; that employers object to it because the nature of the work will not permit of it or that it would not be done as well. Neither of these alternatives are complimentary, however, to the workman, viewed from a standpoint of industrial ethics; and, if the workman's objection be well founded, is far from complimentary to the employer's sense of well-doing. The question thus resolves itself into an admission that the one is ever engaged in trying to get the better of the other instead of both working together in reasonable harmony.

The writer has given this subject a good deal of thought and more or less of trial in both ways, in a forty years' experience; first as workman and afterward as employer; and what he is led to say below has been forced upon him by both experiences. Let it not, however, be concluded that, because he is disposed to lay so much blame at the workman's door for the fact that the subject has been a hard one to decide, that it comes from any thought that the workman is less honestly inclined than the employer. That the workman is in such a degree at fault is because he is the victim of an unwholesome traditional usage or policy, which every workman, as an individual, would do well to cut loose from, if he would succeed in his laudable worldly aspirations.

If a man or set of men have been, for a given hourly or daily compensation, producing certain articles by their labor, more or less aided by labor-saving machinery, and they are induced, by the expectation of increasing said compensation, to change to the piece-work system, the proprietor or employer also expects to be a gainer thereby; and it becomes self-evident, to start with, that the aforesaid man or men, if the results arrived at are accomplished, have not before been performing their plainest duty to their employers, if the latter have been paying a fair equivalent for the work actually performed in the first case. A fundamental statement of industrial ethics for the workman is contained in the proposition that, a workman agreeing to give his services for a certain number of hours per day, for a given compensation, in the production of certain articles of manufacture, is in duty bound to do in those hours all that he can do well, without injury to himself, physically or mentally. If piece-work be substituted for working by the hour or day, and he produces more in the latter than in

the former case, he must either exert his physical or mental powers, or both, to a degree injurious to himself under the piece-work system, or he will have acted an unfair part toward his employer as a day workman.

Men differ in their capacity as producers as they do in their natures, and this renders a difference in their compensation inevitable, and justly so, among men employed at the same industry, whether working by the day or piece; but that the same man should produce more of a given article under a piece-work system than he had previously done by compensation by the hour or day, places the said workman in a rather unenviable light, from an ethical point of view. If Mr. Rose's case, where workmen were given fifteen per cent. less than the previous cost of day-work, resulting in the men making thirty per cent. better pay at the reduced figures, be true, it is plain enough that the workmen performed, under piece-work, nearly double the labor of their heads or hands than while working by the day; and there are no conceivable conditions as to rates of pay that could render such a showing creditable to those engaged in it.

I have known in my experience much more flagrant cases than those mentioned by Mr. Rose—so flagrant, indeed, that under piece-work a workman very soon produced about double, then treble, and finally more than four times the quantity of product that he had for years been in the habit of doing by the day. This only throws a little stronger light upon the fact which the institution of piece-work presupposes: *i. e.*, that day-workmen do less than they ought to for the compensation they have agreed to receive for their labor; and this is by no means to be confined to mere muscular exertion, requiring "their sleeves rolled up and their shirt-collars and neckties taken off in the depth of winter, in a shop with no fires or heat of any kind in it," as Mr. Rose puts it, but is probably to a greater extent dependent on a fair exercise of their mental faculties in the furtherance of production.

There is no more important industrial question to-day, in my opinion, nor one which involves more profoundly the most vital interests of the workingman, than the tendency among them—of course I do not say this tendency is universal—to regard it as to their interest to keep well below their ability to do, in performing the labor of their hands and brains while paid therefor by the hour or day; and I think I may be justified in saying, by way of advice, that this fact alone offers to the workman of to-day the best possible chance for him to climb the ladder of success the world affords, to any set of laborers in life's vineyard. There is no class of men in any walk of life but that coming under the general definition of workingmen who are not engaged in doing their "level best" to excel and get ahead of their competitors, and there is not half the chance for enterprising people in professional and mercantile pursuits to beat their fellows in the race of life, that obtains in shops and among workingmen generally. Success in those is gotten only through comparative merit and absolute capacity, while, for the reasons I have indicated, workingmen may be aided greatly to rise in these days by the fact of the traditional tendency to do less than they may or can do when they are working by the hour or day.

I think I will be entirely within reasonable bounds if I say that if every labor-saving machine used in machine shops in this country were, from to-day, so run by those operating them that the maximum amount of work that is within their capacity to turn out, well and properly done, be caused to be done upon them, there would be not less than one-third more work executed by planers, lathes, shapers, etc., than is now done, because of the mistaken idea held by workmen that it is to their interest not to run them up to their capacity; and this state of things holds, to a great extent, among men not operating such machines. Time was when workingmen banded together to destroy labor-saving machinery, looking upon all such as the workingman's enemy. This phase of industrial foolishness, however, has well-nigh disappeared; but how much better is it to keep a labor-saving machine from producing what it was designed to produce, from a similar mistaken idea? When this equally absurd phase of workingmen's methods is stamped out by themselves, and made to follow the machine-smashing idea, the condition of workingmen will surely be improved.

If labor organizations were instituted with an avowed and executed purpose of instilling into the minds of workingmen the necessity of doing their best always, and instructing them how best to do it, instead of, as now—in some instances at least—practically trying to place every man on a level, which Nature itself prohibits, limiting the amount of their product and otherwise by unwisely interfering, great good would come to the workingman.

Piece-work, then, can only be adopted in the interest of employer and employed alike upon the ruins of the present mistaken traditions on the part of workmen; but every self-respecting workman should be anxious to adopt it for that reason, and let the best man win. It puts every man upon his mettle, and the rate of compensation under piece-work will settle itself under the inexorable laws of supply and demand, just as now by day-work, and no immediate question of comparative day and piece-work compensation would prevent it; simply the industrial world would be so much the gainer, men and employers alike, and it would inevitably hasten that desirable state of things when the world would be satisfied with fewer hours of employment for workmen than is now the rule.

The workman who is the first to "catch on to" the real truth of this matter is the first to succeed, by virtue of availing himself of the great chance that it offers him to rise above his fellows. The man who produces the most of the best quality for a given sum, whether the product of his muscles or his brains, is he who gets to the top first; and, as it has been well said, there is plenty of room there. Under the present mistaken ideas, men are only holding one another back, and huddling themselves in a crowd at the foot of the ladder, while there is open sky and plenty of fresh air and elbow-room above; and the best thing to be said in favor of piece-work, so far as the workman is concerned, is that it offers a better opportunity for the survival, or elevation, of the fittest, than under day-work; and it is my opinion that nothing but good could come to both employe and employer from a general resort to the piece-work system wherever possible, provided the old traditions which drag upon the present system, both as to workman and employer, be thrown off, and piece-work in its very nature will tend to throw them off and bring about a better understanding all around, if entered into and pursued in the same spirit that permeates walks of life not included in industrial production. Then, and only under such conditions, will be brought about Mr. Rose's ideal state of things: *a successful piece-work* system in which the "*cost of the work continues to reduce year after year*, while the workman's *wages increase year after year*," and I might add, the hours of labor be reduced as well.

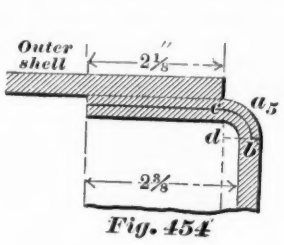


Fig. 454

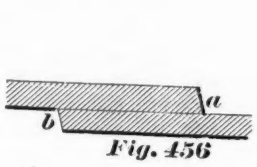


Fig. 456

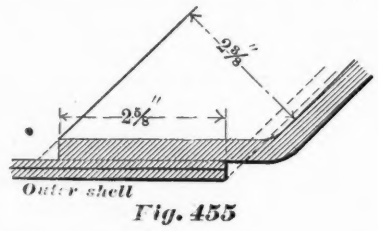


Fig. 455

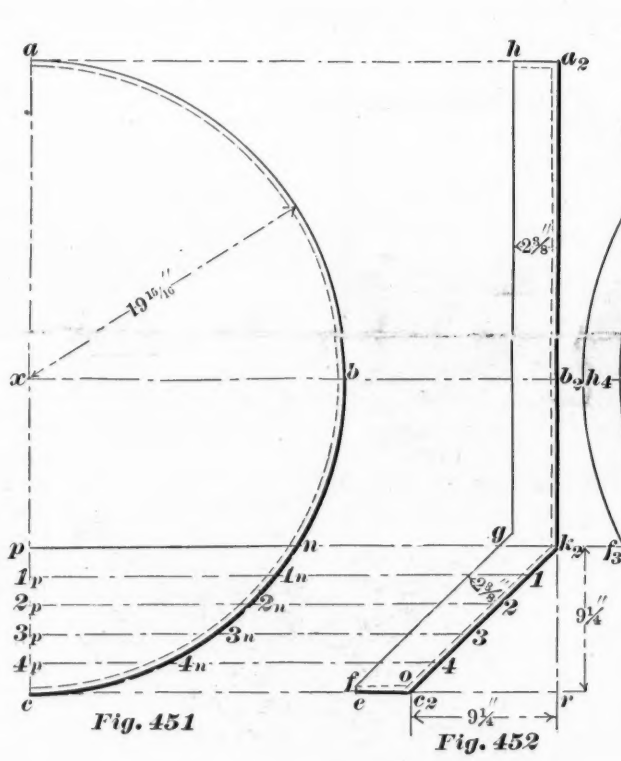


Fig. 451

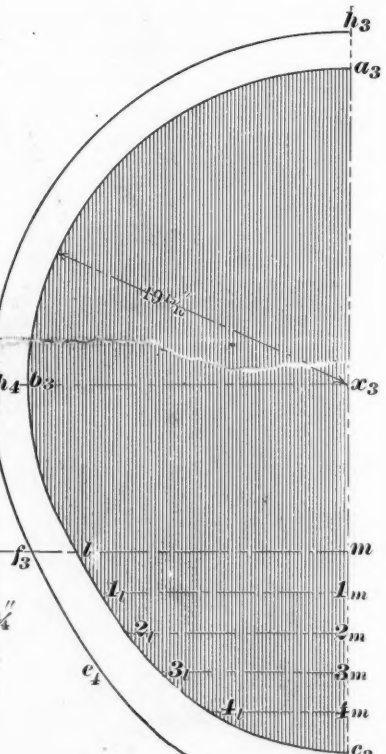


Fig. 452

Fig. 453

Practical Drawing.

Practical Drawing.

By J. G. A. Meyer.

SEVENTY-SECOND PAPER.

Problem 83a continued.

The shaded surface of Fig. 450 (last paper) is the development of that portion of the lower sheet of the outer shell of boiler which is represented in Fig. 448 by the arc $n\ r$; and since the arc $n\ r$ extends only up to the horizontal center line $x\ n$, we conclude that the shaded surface in Fig. 450 is the development, without any allowance for the lap in the longitudinal seams.

The point n, in Fig. 448, is the center of the lap, and since, according to Fig. 446, the total lap is to be $3\frac{3}{8}$ inches, it follows that the sheet will extend $\frac{3\frac{3}{8}}{2} = 1\frac{3}{16}$ inches above the line $x\ n$ (Fig. 448). Now since the point n represents the center of the lap, it follows that the line $l_2\ a_2$ in Fig. 450 also represents the center of the lap, and therefore, to allow for lap, we must draw the horizontal line $p_2\ s_2$, at a distance of $1\frac{3}{16}$-inch above the line $l_2\ a_2$. Hence, the complete development of one-half of the lower sheet of shell is represented by the straight lines $p_2\ s_2$, $p_2\ 6l$, $6l\ 6r$, $s_2\ 1r$ and the curve $1r\ 6r$; to these lines the sheet or plate must be cut.

544. Before a sheet of this kind is bent it is customary to punch or drill the rivet holes; consequently we must know how to lay off the position of these holes.

We have seen that the line $l_2\ a_2$, Fig. 450, is the center line of lap, and, therefore, it must also lie midway between the two rows of rivets in the seam; the distance between the two rows of rivets is $1\frac{1}{2}$ inch. Therefore at $\frac{3}{4}$ inch above the line $l_2\ a_2$, and also at $\frac{3}{4}$ inch below it, draw the horizontal lines marked t and u; these lines will be the center lines of rivets.

Again, according to the general plan, Fig. 447, the center lines of rivets in the transverse seams are to be placed at $1\frac{1}{16}$ inch from the edges of the sheet; therefore, draw the line $u_2\ u_3$ parallel to the edge $s_2\ 1r$, and let the distance between the two be $1\frac{1}{16}$ inch. The point in which the lines t and $u_2\ u_3$ intersect will be the center of rivet nearest to the corner s_2. The rivet holes near the edge $p_2\ 6l$ are not shown, but the center of the rivet hole on the line t nearest the corner p_2 is found precisely in the same way as we have found the center of the hole next to the corner s_2. Now, having established the centers of rivets nearest to the edges of the sheet, we divide the distance between these two centers into a number of spaces each equal to $3\frac{3}{8}$ inch, or as nearly equal to $3\frac{3}{8}$ as we can divide it so as to make all the spaces equal to each other; the points of division thus obtained will be the centers of the rivet holes on the line t. The distance between the centers of rivets on the line u must of course be equal to that between the centers of rivets on the line t, and must be laid off so as to make the arrangement of the rivets on the center lines t and u zig-zag.

545. It now remains for us to find the center line of rivets near the curved edge $1r\ 6r$. To do so, lay off on each one of the horizontal lines $6l\ 6r$, $5l\ 5r$, $4l\ 4r$, etc., from their extremities $6r$, $5r$, $4r$, etc., a distance equal to that between the points $2j$ and $2g$, or that beween $3j$ and $3g$ in Fig. 449 (these are equal to each other); through the points $6v$, $5v$, $4v$, $3v$, $2v$ thus obtained, draw a curved line intersecting the line $u_2\ u_3$ in the point u_3; this curved line will be the center line of rivets.

On the line $u_2\ u_3$, commencing from the center of rivet hole next to the corner s_2, lay off spaces equal to the pitch of rivets, namely $2\frac{1}{8}$ inches, and continue these spaces on the curved line $2v$, $4v$, $6v$; the points of division thus obtained will be the centers of the river holes.

546. In order to save time and labor in laying off the position of rivet holes, the boiler maker uses thin wooden templates (sometimes called regulators) having holes spaced to suit the different distances between rivets.

In order to use these templates we first lay off on the plate the center of the rivet hole near the corner s_2, and also that near the corner p_2, as previously explained. The template having the correct pitch of rivets is then selected and laid on the sheet, with the centers of two of its holes coinciding with the centers of the rivet holes near the corners s_2 and p_2; the positions of the intervening holes are then marked off with a small round stick called the marker; this marker is first dipped into some liquid whiting and then passed through the holes in the template, making small white circles in the plate, which indicate the positions of the rivet holes.

547. In a few shops the punching machines are designed specially for punching boiler plates; when such machines are used, it is only necessary to lay off the rivet holes next to the corners s_2 and p_2; the plate is then fastened into the proper position in the machine, which is set to punch the intervening holes at the proper distances apart; the distances between the rivet holes punched by these machines are very accurate; in fact, more so than those which are laid off by hand.

Directions.—On one of the sheets of paper, 20x15 inches, find the development of lower plate of the shell. To do so the student should first study this and the preceding article carefully, and also take the dimensions of that part of the shell which is to be developed. The articles on this subject should then be laid aside, and Figs. 448, 449, 450 drawn from memory, according to the dimensions previously taken. The student should not be satisfied until he can do this, and prove the correctness of every step in the construction. Use a 3-inch scale.

Problem 83*b*.

548. Our next sheet to lay out will be the back head marked *E* in Fig. 447. To do so, we must first draw on the blackboard two views of this head, as shown in Figs. 451, 452. These views should, of course, be drawn full size.

From any point x (Fig. 451) as a center, and with a radius of $19\frac{15}{16}$ inches (which is the radius of the inner surface of the shell) describe the semi-circle $a\ b\ c$; through the center x draw the vertical line $a\ c$. The dotted semi-circle represents the inner surface of the flange; we have shown it here for the sake of completeness; it need not to be drawn on the blackboard.

Fig. 452. At any convenient distance from Fig. 451 draw the vertical line $a_2\ r$. Through the extremities a and c of the diameter $a\ c$ (Fig. 451) draw horizontal lines $a\ a_2$ and $c\ r$, meeting the line $a_2\ r$ in the points a_2 and r. From the point r lay off on the line $a_2\ r$ a point k_2; the distance between the points r and k_2 must be $9\frac{1}{4}$ inches; the distance $r\ k_2$ represents the vertical height of the sloping part of the sheet. Again, on the line $c\ r$ lay off a point c_2, and make its distance from the point r equal to $9\frac{1}{4}$ inches; the distance $c_2\ r$ represents the horizontal distance of the sloping part of the head; the numerical value ($9\frac{1}{4}$ inches) for the height $r\ k_2$ and the distance $c_2\ r$ is of course taken from our general plan, Fig. 447. Join the points k_2 and c_2 by a straight line; the lines $k_2\ c_2$ and $a_2\ k_2$ represent the outer surface of the back head. Our construction, so far, is precisely the same as that adopted for obtaining the lines $a\ c$ and $c\ d$ in Fig. 449 (last paper). The outer surface, $a_2\ h$, of the flange must be made equal to the sum of the thickness of the head and the inner depth of the flange, namely, $\frac{5}{16} + 2\frac{3}{8} = 2\frac{11}{16}$ inches. Through the point h draw $h\ g$ parallel to $a_2\ k_2$; also draw the line $g\ f$ parallel to the line $k_2\ c_2$; the distance between the lines $k_2\ c_2$ and $g\ f$ must also be equal to $2\frac{11}{16}$ inches. The dotted lines in this view represent the inner surfaces of the head, and, if correctly drawn, the distances from the edges $h\ g$ and $g\ f$ to the dotted lines will be $2\frac{3}{8}$ inches.

We have now two views of one-half of the back head, and these two views show us the appearance of the back head after it has been bent and flanged.

The junctions at a_2, k_2 and c_2 are sharp, instead of curved, as they should have been; but since the radii of the curves with which these junctions should have been made are comparatively short, we may consider the junctions to be as shown in Fig. 452, and thereby greatly simplify the construction without introducing any appreciable errors.

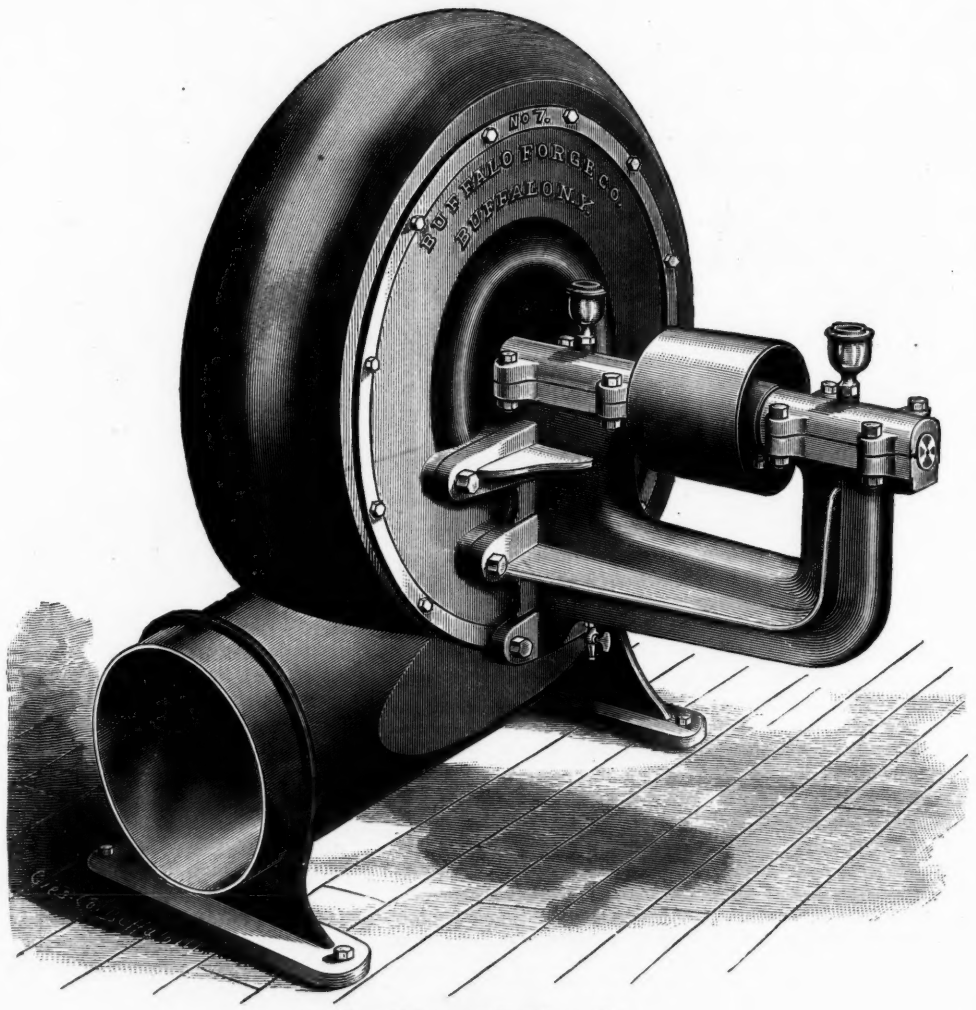
Through the point k_2 draw a horizontal line, $k_2\ p$, cutting the semi-circumference $a\ b\ c$ in the point n, and the diameter $a\ c$ in the point p. Divide the line $k_2\ c_2$ into any number of equal parts, say five, and through the points of division 1, 2, 3, 4, draw horizontal lines, cutting the semi-circumference $a\ b\ c$ in the points $1n$, $2n$, $3n$, $4n$, and the diameter $a\ c$ in the points $1p$, $2p$, $3p$, $4p$. This now completes the preliminary views on the blackboard, and these views we require for laying out the outline of the sheet, as shown in Fig. 453.

We shall now assume that the outlines in Fig. 453 are to be drawn directly on the plate. Through the center of the plate, and parallel to its edges, draw the line $h_3\ e_3$; on this line lay off a point, x_3; from this point, as a center, and with a radius of $19\frac{15}{16}$ inches, describe the arc $a_3\ b_3\ l$; the point l of this arc cannot now be established, consequently describe the arc in this direction long enough. From the center x_3 lay off on the line $h_3\ e_3$ a point m, and make the distance from x_3 to m equal to $b_2\ k_2$ in Fig. 452. From the point m lay off in succession on the line $h_3\ e_3$ five spaces, each equal to one of the spaces on the line $k_2\ c_2$, that is, equal to the distance between the points 1 and 2, or that between 2 and 3, and thus obtain the points of division $1m$, $2m$, $3m$, $4m$. Through the points m, $1m$, $2m$, etc., draw horizontal lines. Make $l\ m$ equal to $n\ p$ (Fig. 451); $1m\ 1l$ equal to $1n\ 1p$; $2m\ 2l$ equal to $2n\ 2p$, and so on. Through the points l, $1l$, $2l$, $3l$, $4l$, c_3 draw a curve and thus complete the shaded surface which is the form of one-half of the sheet without a flange.

To this we must now add an amount necessary for the flange. In Fig. 452 we see that the flange is to project $2\frac{3}{8}$ inches; hence on the line $h_3\ e_3$ (Fig. 453) lay off a point h_3, and make its distance from a_3 equal to $2\frac{3}{8}$ inches. From the center x_3, and with a radius $x_3\ h_3$, describe an arc $h_3\ h_4\ f_3$ (for the present make this arc long enough in the direction f_3); again on the line $h_3\ e_3$ lay off a point, e_3, and make the distance from c_3 to e_3 equal to the depth of the flange $f\ o$ (Fig. 452); through the point e_3 draw towards f_3 a curve; the distance between this curve and the curve $c_3\ 3l\ l$, must gradually decrease, until finally the curve $e_3\ e_4\ f_3$ becomes tangent—in the neighborhood of the point f_3—to the arc $f_3\ h_4\ h_3$. This completes the outline of the back head before it is bent or flanged, and the sheet must be cut to the arc $h_3\ h_4\ f_3$ and the curve $f_3\ e_4\ e_3$.

549. The amount allowed for the flange will be slightly more than is necessary; the reason for this is seen in Fig. 454, which represents, on a larger scale, the flange around the circular portion of the head; notice that at a_5 the junction of the flange and the head is circular, but we have assumed it to be square, and therefore the amount allowed for the flange will be a trifle more than required for a junction as shown at a_5.

550. Fig. 455 represents the flange at the lower portion of the head. Here we notice that the outer sheet overlaps the flange $2\frac{3}{8}$ instead of $2\frac{1}{8}$ inches, as shown in Fig. 454; this is caused by making the edge $f\ g$ of the flange (Fig. 452) parallel to the outer surface $k_2\ c_2$ of the head. The amount of overlap in Fig. 455 also gives the reason for allowing more for the flange at $c_3\ e_3$ (Fig. 453) than that allowed at $a_3\ h_3$. In the case before us there is no particular objection to the outer shell overlapping $2\frac{3}{8}$ inches on this particular part of the flange; indeed, such an allowance may in some cases be advantageous, as it is difficult to flange plates exactly to the correct shape, and the amount which we have allowed for lap in Fig. 453 (apparently too large) may be required to make the overlap at the bottom of the head equal to that at the top of head, namely, $2\frac{1}{8}$ inches, as shown in Fig. 454, which, in this case, is the smallest overlap admissible.



THE BUFFALO EXHAUST FAN.

551. So far we have shown the edges of the sheet to be square, and indeed for the purpose of laying out the sheet we should always consider these edges to be square. In reality, the edges of the sheets before calking are not square, but will appear as shown in Fig. 456.

Directions.—On one of the sheets of drawing paper, 20x15 inches, find the development of the back head. Use a 3-inch scale.

The decision of the Commissioner of Patents, in which he refuses to re-open the cases of some of the contestants of priority of invention in the Bell telephone patents, will give the people all the benefits of monopoly, about which we are told so much. According to the theory of those who believe monopoly cheapens prices, there will not be, much longer, reason for the complaint of exorbitant charges for telephone service.

The old saw-mill at Rocky Hill, Connecticut, supposed to be the oldest in the country, has been torn down. It was known far and wide as the old Ephraim Goodrich saw-mill, and was of the most primitive construction imaginable. The saw was a cumbersome horizontal affair, set in a monstrous wooden frame, propelled by a natural waterfall upon a big wooden wheel, an invention of past ages. When the machinery was set in motion, the earth for miles around reverberated with the most hideous noises, and the work was slow. It was told of old Ephraim, that, after starting a prodigious log upon its road of separation, he used to lie down upon the carriage and sleep the weary hours away, awakened when the log had run its race by the comparative stillness of the mill. A new grist-mill is now building on the historic site. —*The Industrial Journal.*

The Buffalo Exhaust Fan.

We illustrate herewith a new exhaust fan which possesses several distinguishing features, prominent among which is the solid case, the peripheral portion of the shell or case being cast in one solid piece, to which the center plates are accurately fitted, metal to metal, without the interposition of any other substance whatever. It is claimed, as the result of this manner of construction, that the fan is practically one piece, and that, under any service, the bearings must always be in perfect alignment vertically and laterally with the rest of the machine.

The journals are long and heavy, supported by the arm having planed surfaces fitted accurately to the body of the fan. By means of a system of gauges and templates, the different parts of the fan are so proportioned and fitted each to the other, that at the highest speed there is practically no vibration. Both bearings of the exhaust fan are on one side, leaving the inlet entirely unobstructed.

These exhausters are especially adapted for removing smoke and gas generated in blacksmith shops, chemical works, and factories in general; for removing dust from emery and other polishing wheels, buffing machines, and for the removal of offensive odors from try kettles, varnish factories, etc.

These fans are made by the Buffalo Forge Co., Buffalo, N. Y.

Making Elbows, Bends and Branch Pipes in Loam.

BY S. BOLLAND.

FIRST PAPER.

In a previous article on this subject, a method for moulding such castings, when but one of a kind is wanted, was described. We will now consider some other methods which will best meet the case, when the order is for a sufficient number to warrant the necessary outlay for casings, etc., by which means the founder can produce castings with greater facility and at less expense.

In order to give a clear exposition of the method of moulding pipes in casings, let us proceed to make a 24-inch socket pipe, 10 feet long, and bent to 14 feet radius. The succeeding instructions will serve for flange pipes as well.

Fig. 1 (page 4) is a sectional view of top and bottom halves of the casings required for moulding such a pipe. The thickness is 1 inch all through, strengthened by ribs, 2 feet apart, extending all round, from flange A to flange B, as indicated by the outer line. Lugs for lifting purposes are shown at C, D, E, and F; these may be either separate or attached to the ribs, according to circumstances. In this instance $1\frac{3}{4}$ inches is allowed for loam, which is held to the casing by the prickers shown. Let these prickers be $1\frac{1}{4}$ inches at the base, and $\frac{1}{4}$ inch at the top, for if they are made any lighter than this their life is short. They may be set in about 6 inches apart, and vent holes cast in the same ratio.

It will be seen at G that provision is made for holding a stud with which to support the core; this socket is made to receive a stud 1 inch in diameter, and must be set in exact position to catch the packing H, which, as

shown, extends from the surface of the core to bar *I*. Provision for holding down the core is shown at *J*, consisting of two clamps of wrought-iron, 1¼ inch square, cast in the casing; one on each side of the hole through which the stud *K* is dropped. A stout bar, resting on the stud, and firmly wedged under these clamps, secures the thing at once.

This stud *K* is seen to rest on a wrought-iron plate, 4 inches square and ¾ inch thick, and between this and the packing *L* is inserted a piece of wood 1 inch thick, and of the same dimensions as the plate; this wood burns away in due time, and releases the core iron. Of course the casing is made to the form of the pipe, as seen at section of socket end, Fig. 2; and it is best to allow 6 inches extra length, as shown at *A*. The core, extending the same distance past the bearing, forms a space into which sand may be rammed all round after the mould is closed; and by this means make it impossible for the iron to escape at any part of the bearings.

The mode of sweeping this mould is shown in detail at Figs. 2, 3 and 4. Fig. 4 represents a frame of cast-iron, made to the outer dimensions of the pipe on its inside edge (only at the print ends, which must be the width of the core at that place), and whose outside edge corresponds to the casing at *A*, *B*, Fig. 1.

This frame and a body sweep, in conjunction with the spindle attachment shown, constitutes the whole arrangement for forming the outside of the mould.

It will greatly facilitate the operations if the casings are set one on each side of a vertical spindle, with which to sweep off the joints; and should the spindles already erected not be available, one can very readily be extemporized for the purpose. The joints may be rammed with dry sand facing and swept with a straight board, after which the iron frame is placed thereon, and the mould formed.

It will be seen that the spindle *B*, Fig. 2, works in a loose bush, which is held in its place by a set screw *C*, and that it is prevented from moving endways by the collar *D*. The reason for having this loose bush is obvious; the center of the spindle must be on a line with the joint of the mould, as seen in Fig. 3, and when the frame is reversed, and placed on the other half, the bush must be moved to bring the center on a line with the joint, as in the former instance. If this were not done, two frames would be required, and four holes bored instead of two.

The horizontal spindle serves to form the ends, and also the bearings for the core, and, as will be plainly seen, flanges may be swept with the same facility as plain ends. The body of the pipe is formed by a sweep, made to rest on the frame as it is drawn from end to end. By using one frame for both halves an absolute fit is obtained by simply smoothing off the loam even with the outer edge of the frame in both cases, and carefully matching them when closing the mould.

The mode of pouring in this case will be governed by the style of core used. Should the core be made of a material which will allow the iron to be dropped on the top, a sufficient number of holes must be cast in the casing for the purpose of forming the gates. Or, if it is thought best to make the bottom half in dry sand, and the top green, then provision can be made in the bottom casing for the insertion of the necessary gates, and securing the runner box in which the pouring basin is to be made.

Again, should an entire green sand core be used, it will be best to provide for running in at the end, by casting holes at one end of the top casing for upright runners to connect with gates cut round the bottom bearing; these again connecting with the casting in the direction of its length. Such a runner is easily made by attaching a finger-piece to the sweep, at the point where it is intended to run the pipe, connecting it with the mould afterwards. The latter mode will be found applicable in nearly all cases, and is by far the best method, owing to the fact that neither cope nor core offers any opposition to the free ingress of the iron.

The labor of making cores for this job will be appreciably lessened by providing a half core-box of cast-iron in which to make them. When such a box is furnished, all that is needed in the way of core-iron is a stout bar, made to the curve of and central with the pipe, on which loose frames are wedged fast along its length, at a proper distance from each other, as shown in section at Fig. 1. With such a rig as this it is only required to ram about 6 inches of sand solid all round, filling the inside with coarse cinders as the ramming progresses. The top half can be swept off with a strickle, made to work on the edges of the half box, and any little deviation from a correct half in the iron box can be rectified by adding to or reducing the strickle, as occasion requires.

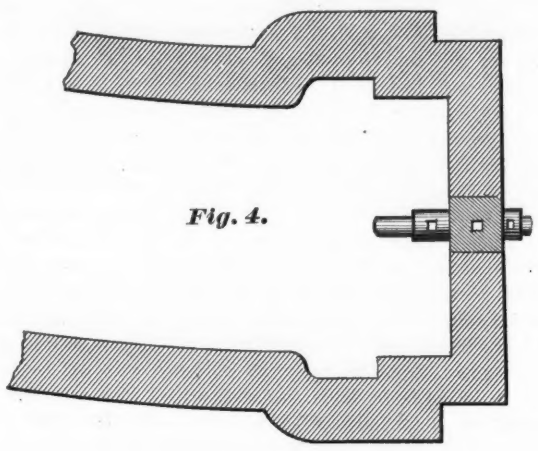


Fig. 4.

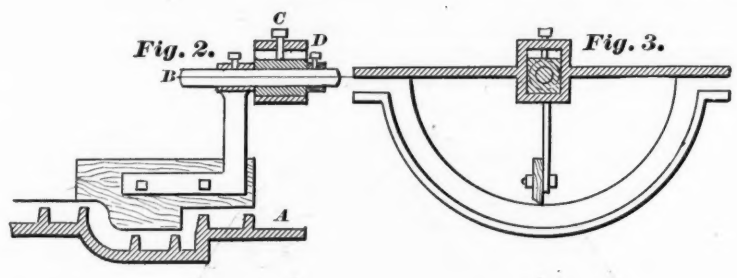


Fig. 2.

Fig. 3.

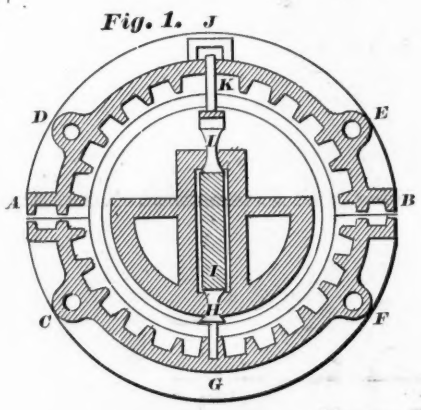


Fig. 1.

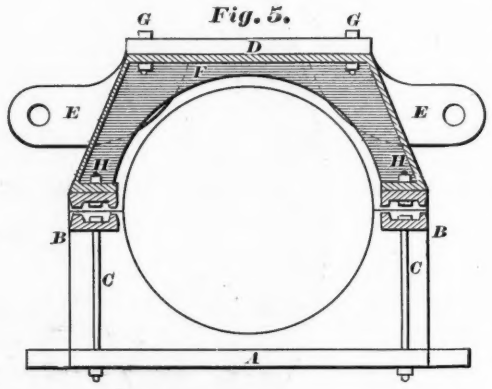
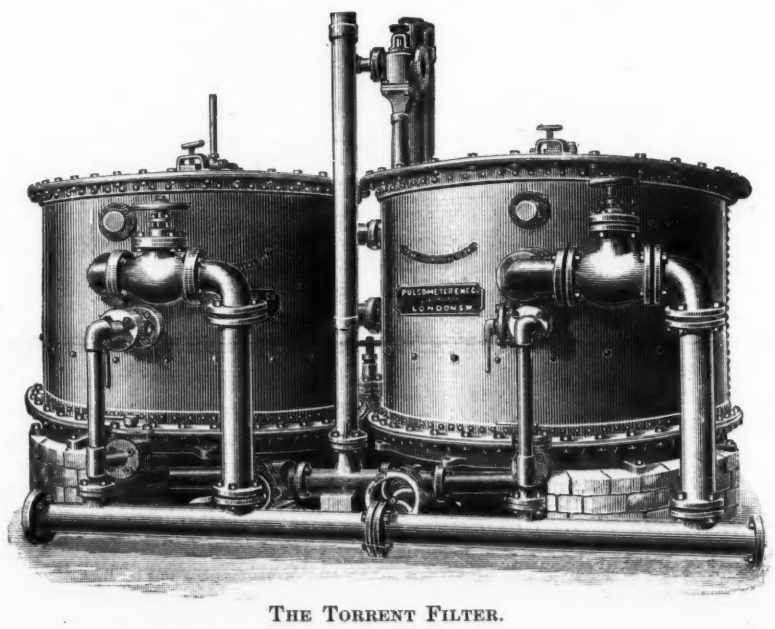


Fig. 5.

Making Elbows and Pipes.

The utility of the method herein suggested for sweeping pipes is not by any means confined to moulding in casings. By referring to Fig. 5 it will be seen how easily it may be applied to a regularly built mould, so prepared that an almost unlimited number of pipes may be cast therein with absolute safety, the frame and horizontal spindle being used in exactly the same manner as directed for the casing. The inner circle represents the mould, the bottom half of which is built on foundation plate *A*, up to the points *B*, *B*, where another plate, which is a fac-simile of the flange on the casing, is placed and secured by bolts *C C*.

For the top half, make the covering plate as shown with lugs, or handles *E*, *E*, set convenient for lifting and rolling over. Let holes be cast about every 12 inches along each side of the plate, for the purpose of securing cross bars *F*, which, as shown, have flanges, with holes cast to correspond with those cast in the top plate. Bars and plate are then made one by bolts *G*, *G*, and similar plates to those at *B*, *B* are secured to these bars by bolts at *H*, *H*. The bars, having a flange along their outer edges, hold the bricks firmly in their place, while the lugs *E*, *E*, extending beyond the outermost part of the mould, and set central with it, allow the cope to be rolled easily either one way or the other, resting on them (the lugs) throughout the whole operation of reversing.



The Torrent Filter.

The Torrent Filter.

The engraving accompanying this is of a filter designed for use in connection with water-works for purifying river water to make it suitable for drinking purposes or for manufacturers requiring pure, clean water for use in manufacturing processes or in the boilers of the power plant. In England, where it is made, it is meeting with very gratifying success for the purposes indicated.

The body of the filter is of wrought-iron, and contains a layer of charcoal or other filtering material resting on a perforated bottom covered with wire gauze, the character and thickness of this layer of filtering material depending upon the requirements and the kind of water to be filtered. Under this is a distributing arrangement by which numerous small jets of air are introduced, the pressure being supplied by a pump or blower. The inlet for the water to be filtered is above the filtering material; the outlet for the clean water at the bottom of the apparatus.

At the upper part an outlet is provided for the exit during the process of cleaning of the accumulated dirt and impurities. Access to all parts where it is needed is provided for by man-holes. The filter will work continuously without diminution of flow or thoroughness of action, for a time varying from 5 to 40 hours, according to the character of the water.

When it is required to clean the filter the ordinary supply and outlet valves are closed and through another pipe the cleaning water is introduced. Above the filtering material is an outlet pipe, through which the accumulated mud is washed out by the reverse current.

This, however, is not of itself sufficient to wash away adherent impurities; but by opening the cock for admitting the air pressure the filtering material and impurities are violently agitated and loosened, thus making it practicable for the latter to be carried off by the current of water As soon as the outflowing stream shows that the impurities have been carried away, the former conditions are restored, and the filtering operation resumed, the filtering material settling to its normal position within thirty seconds. This filter has been adopted by various public departments, as well as by various private manufacturers, who report very efficient action and great economy over other methods. The manufacturers are the Pulsometer Engineering Company, Limited, London S. W., England.

A Reading Room.

G. A. J. Brown, Haughville, Ind., writes us:

By the liberality of the proprietors of the several iron works situated in the village, and the endeavors of the workingmen themselves, with some help from the other citizens, we have been enabled to start quite a neat little reading room at a cost of five cents a week to members, and hope in the future to add something of a library.

As a result of a collision between the two sections of a freight train on the Cincinnati Southern Road, near Sunburnt, Tenn., that road is likely to suffer what is probably by far the heaviest loss ever sustained from such an accident. The collision occurred in a tunnel, which had pierced several seams of coal, and the forward section of the train, consisting largely of loaded oil tanks, was ignited from the fire-box of the colliding engine. The burning oil set fire to the coal seams, and it is likely that they will be completely burned out, in spite of all that can be done to prevent it. The total loss is estimated at about $600,000.

It is demanded of the locomotive engine that it shall furnish steam to heat the cars in its train, and now the *Tribune* suggests that it be made to furnish power to generate electricity to light them, as "the problem seems a simple one." A locomotive fireman could tell the *Tribune* that even now the problem of keeping up steam is rather a complex one, that is, if it is allowed he knows anything about it. There is nothing new in the suggestion, however, as locomotive boilers are at present made to furnish power for lighting trains, but the subject is far from being simple.

Plowshare Grinder.

We illustrate with this a grinder designed especially for grinding and polishing plowshares, though the features which make it specially adapted for this work also make it desirable for grinding any other castings which are so heavy that it is necessary to handle them on a truck instead of holding them to the wheels by hand.

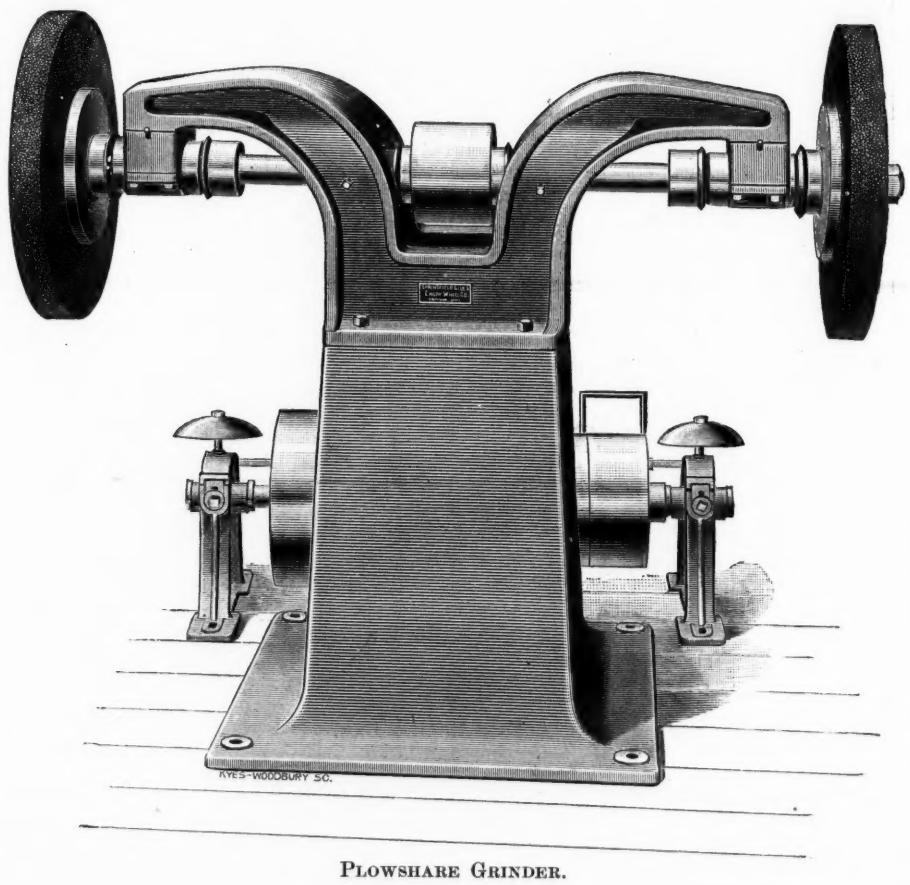
The machine has a very heavy square base, with a liberal spread, so that it will stand firmly on the floor and be free from undue vibration.

The arbor, as will be seen, is long, and is held in four bearings. The long arbor is required to give clearance to large work.

Following are some of the principal dimensions:

Weight, without wheels, 1,600 pounds; height from floor to center of spindle, 42 inches. Height of base, 30 inches. Length of two outside bearings, 8 inches, and are self-oiling. Length of two inside bearings, 6 inches, located each side of pulley and not shown in cut. Diameter of spindle in bearings, 2¼ inches. Diameter of spindle where wheel goes on, 2 inches. Distance between wheels, 60 inches. Distance spindle extends beyond frame, leaving clear space to handle work, 21 inches. Entire length of spindle, 71 inches. Spindle pulley, 8x6 inches. Carries two wheels any size up to 30 inches diameter. Floor space of base, 34x34 inches. Driving pulley on countershaft, 20x6 inches. Tight and loose pulley, 16x8 inches.

This machine is made by the Springfield Glue and Emery Wheel Co., Springfield, Mass.



PLOWSHARE GRINDER.

LETTERS FROM PRACTICAL MEN.

Theory Regarding the Traction Efficiency of the Electric Locomotive.

Editor American Machinist:

Reference has been made to the fact that the electric locomotive will draw a considerably heavier load than the steam locomotive of the same weight, and the suggestion advanced, that it is due to some electric condition of the rails and wheels. While I believe it has been clearly shown that certain things slide one upon the other much more freely when a current of electricity is passing from one to the other than when not, I do not know whether, in the case of the 9th Ave. cars, the electricity passes from the wheels to the track, but if it does the result is quite the reverse from the action assumed in the case of the locomotive wheels, and it does not seem at all necessary to refer the matter to any electrical or magnetic theory, as the mechanical conditions alone are such as to explain the apparent inconsistency, and in this way: The power of the electric motor is constant and the steam intermittent. If the steam locomotive has but a single cylinder, and the power required to draw the train be seven hundred pounds, the force exerted by the piston would be nothing when the crank was at the dead center, and eleven hundred pounds at the maximum; so that, while the electric motor doing the same work would exert only seven hundred pounds towards slipping the wheels, the steam locomotive with one cylinder would at times exert a force of eleven hundred pounds. This assumption does not take into account the varying steam pressure nor the angularity of the connecting rod, which in certain positions would make it more, nor the weight of the reciprocating parts and inertia of the drivers, which would make it less, though, as slipping takes place in starting the train, the inertia would have but little influence.

It is true that steam locomotives are not single cylindered, and at first sight it would seem that that makes a vast difference, and that with two cylinders the impulse is almost constant; but even assuming the steam pressure to be constant throughout the stroke, as was assumed with the single cylinder, the rotary effect of the two cylinders is not constant, and (unless I am badly mixed in my diagram) with a mean of fourteen hundred pounds, or double the mean of the single cylinder, there will be a minimum of eleven hundred pounds, and a maximum of fifteen hundred and seventy-one pounds. This variation, together with the varying steam pressure on the piston, it would seem, is sufficient to account for the extra efficiency of the electric motor, if I am correct in my assumption that the limit in both cases is the slipping of the drivers.

JOHN E. SWEET.

Crank-Pin Areas.

Editor American Machinist:

I have read the letter of Mr. Louis Kunz relating to crank-pin areas, published in your issue of Feb. 21st.

I confess I am somewhat surprised to see a comparison of locomotive and marine engine crank-pin pressures made in dead earnest by anyone; especially with a view of arriving at the proper area for steam engines in general.

If Mr. Kunz can conveniently visit the Stevens Institute of Technology at Hoboken, N. J., he will there find a car-wheel axle running in *every way* under the same conditions (except a dusty road bed) that he finds it when under a heavily loaded freight car or Pullman coach.

In order to complete these conditions, a fan blower is placed with its discharge nozzle facing the truck housing, journal and box, and the speed of the current of air coming from the nozzle of the fan is equal in all cases to the various speeds of passenger and freight trains. Mr. Kunz can there see that a loaded journal running in an ordinary machine shop shows one condition, and that the same journal running in a blast of air with speeds varying from ten to sixty miles an hour, shows quite another condition.

If the good people at the Stevens Institute should continue these journal experiments, they may sometime conclude to practically illustrate the frequently unhappy condition of the marine engine crank-pin.

I will not attempt to describe an experimental apparatus to fully illustrate the real *practical* conditions under which this class of crank-pins work, but it would necessarily be rather expensive in construction. For the first condition, we would want the temperature of a *very* badly ventilated engine room raised to 90°, 100°, and even as high as 115°, as these temperatures generally rule. For the second condition we would require a device to imitate a genuine case of continued "racing" of the engines during a tough "norther." For the third condition we want the *main* shaft with the crank-pins suddenly forced at one angle, while the frames, guides, etc., were going off on other angles to suit the varying caprices of the ship's frames, keelsons, etc. For a fourth condition, we must prepare to run our marine engine pins during one hundred and eighty consecutive hours; a locomotive pin runs continuously from two to seven hours. Then again, if our pins should happen to heat, they would be obliged to "grin and bear it," as the ship must, in case of storm, have her headway kept on, or go into the trough of the sea, perhaps, before steady-sails could be set and made to draw well. When I say a marine engine pin should not be subjected to more than 400 lbs'. pressure per square inch I am making the *absolutely necessary* allowance for all the conditions just named.

Stationary engine crank-pins running on firm foundations, under room temperatures ranging from 65° to 80°, with good reliable lubricants, can have pressures from 500 to 800 lbs. per square inch, but they will heat and cut very badly if the oiling device does not perform its work well.

I leave Mr. Meyer to defend the much abused locomotive crank-pin, feeling perfectly assured that he will not find it necessary to apply to "some experienced steam engine designers" for assistance.

W. H. HOFFMAN.

Barometer Readings.

Editor American Machinist:

Not long since one of your correspondents, over the signature of "Packing," asks whether the reading of a barometer placed in an engine room will not be affected by the difference of the density of the air in the room, as compared with the outside atmosphere. To this I reply no; for the air in this room is in free communication with the air outside, and though it differs in density, it still acts with perfect efficiency as a transmitter of the atmospheric pressure through the keyhole and door chinks. Doubtless "Packing" has noted that the readings of an inside and outside barometer are different, but this is simply because a column of hot mercury is lighter than one of equal height but cold, and therefore a column of mercury in an engine room will read higher than one outside and colder. Most pocket-books give correction tables to apply to barometer readings for temperature, but where a barometer and vacuum gauge stand side by side they will be equally affected by heat, and the very small difference between their differences when hot and when cold is too slight to affect a reading, and thus, no matter how hot the engine room, the differences of the two columns will show the lack of absolute vacuum, almost exactly the same as when cold. In few, if any engine rooms will the mercury differ by more than one per cent. of its height. Thus a vacuum of 27 inches and a barometer of 30 inches differ by 3 inches, we will say, at the lowest temperature. The temperature rises 90 degrees or so, and the two columns will rise to 27.27 and 30.30, so that their difference is now 3.03 inches. Their difference is thus a bare ·32d greater than it was when cold. If, however, the barometer were at the entrance porch and the vacuum gauge on perhaps a steam pipe, their difference of reading might be as seen over a quarter of an inch in error; but this would be due to temperature only, not to any difference of density. Indeed, the column in the heated and less dense air stands higher than that in the cold and heavy air, showing the difference to be in the weight of the mercury.

W. H. BOOTH.

Manchester, England.

Mounting Drawing Paper and Tracings.

Editor American Machinist:

Allow me to give my practice in the matter of which "Pedro" wrote in the issue of Feb. 7—the mounting of drawing paper. He gives two rules, to which I add a third: *Use good common sense.*

I have used a large amount of bond paper, and do not remember to have had a single failure in obtaining good results. My method is as follows: I cut my sheet nearly the size of my board, and having my board perfecly dry and clean, I lay the sheet upon it and turn up the edge all around about ⅛ of an inch, thus making a shallow pan; then, taking a clean sponge full of water, I *wet* the entire surface of paper, edges and all, taking care that no water gets on the back side of the edges on the board where the glue is to come, then with my prepared glue *warmed*, I glue one edge and stick it fast to the board, and stretch the paper, as I do so, and rub it well down onto the board with a smooth rubber, like the ivory handle of an eraser. By the time you have gone around the four edges, your board being dry and the glue warm, it will set and there will be no danger of its not sticking. Then take your sponge and take up all the superfluous water from surface of paper, and see that the moisture is as even as possible, and when dry you will have a surface which is a delight to work on.

As to mounting tracings on cardboard or common board, paste, mucilage or glue ought not to be used. Dampen the tracing, so as to give it stretch, then give the board upon which tracing is to be mounted a coating of shellac varnish, apply the paper, commencing at one edge and holding the other opposite edge up, so that but a small part of tracing comes in contact with board; press it down in same manner that paper hangers do with wall paper, and if the work has been carefully done, there will be no trouble with air bubbles. If the tracing is of considerable size, varnish only a portion of board at a time.

C. C. COLLINS.

Newark, N. J.

Covering Shafts with Plaster of Paris.

Editor American Machinist:

In your issue of Feb. 21st you ask for information on behalf of a correspondent who has trouble in covering 3½" × 6 feet shafts with plaster of Paris. The following directions with proper care will insure success:

1st.—The shaft must be freed from grease of any kind, by washing with a warm solution of carbonate of soda (washing soda) or concentrated lye.

2d.—The plaster of Paris should be heated in some flat receptacle and stirred meanwhile, to expel all moisture and gases, and sifted in a fine sieve immediately before mixing with water, while still warm (unless freshly ground plaster of Paris can be procured, which is of course the best).

3d.—The shaft and mould should stand at about 30° with the vertical. The mould may be simply a piece of sheet-iron or zinc lapped around and held in position by wiring, with a centering piece at each end.

If a large number are required, the mould should be made of three segments; in either case the mould should be oiled inside, to insure easy withdrawal (raw linseed oil is the best). The plaster of Paris should be mixed to the consistency of cream; the pouring should begin in a small stream against the lower side of the mould, gradually increasing until full. I would use no less than three buckets for mixing at once, to insure continuity and facility in pouring. As soon as the mould is filled it should be raised to a vertical position, and the shaft should be struck several smart blows (with a large mallet) on the end, to settle the wrinkles.

The danger of cracking from shrinkage (due to the great length) in drying will still exist, in which case a very thin mixture of plaster of Paris painted in with a camel-hair pencil will rectify the evil.

A. E. Dupas.

New Orleans, La.

Editor American Machinist:

If your correspondent (page 4 of Feb. 21 issue) will mix his plaster of Paris by first having water in the vessel and then putting the plaster in and allowing it to sink to the bottom before stirring — he will not be troubled with air holes. J. B.

Watson & Stillman's Time-Keeping.

Editor American Machinist:

In the notice of our new system of time-keeping I notice one slight inaccuracy, which, if true, would tend to make it more inconvenient for foremen to give the slips out.

The slips are made up in pads of 100 each, which gives a backing upon which to write, and keeps them in good condition. This prevents their being stamped *before* giving out, without unnecessary trouble by foreman. The slips of one day are all stamped by time-keeper after taking them up.

The new system has already enabled us to settle several disputes favorably.

F. H. Stillman.

Expansion Joints.

Editor American Machinist:

D. W. L. asks for the opinion of the readers of the American Machinist regarding expansion joints. For one, I will say, don't use them if you can help it. There are very few places where the expansion of pipes cannot be provided for in some other manner. If no other means were possible, I should use a slip joint with the pipe securely held in position, so there could be no vertical or sideways movement of it. It should be packed with great care, especially as regards tightening up the gland evenly, so as not to bind the sleeve. I have seen a brick wall bulged out, where an expansion joint refused to operate. In this case it was owing to the floor from which the pipe was suspended settling from an overload of goods. There are corrugated copper joints that are highly spoken of by some, but it seems to me that the continual springing of the metal would in time cause a fracture, especially if the movement was large. Peter H. Bullock.

Another Stick in the Hogshead of Water.

Editor American Machinist:

I saw in the February 7th number a question (52) asked by Mr. Lee Whitaker, in regard to a tank of water not freezing and bursting when there was a stick of wood in the tank.

I will relate my experience: Several years ago, when I was a boy, my father bought a large hogshead which was about 4′ 6″ diameter and 5′ deep, to catch rain-water from the roof of the house. When he had paid for the hogshead he said to the man from whom he bought it, "Well, I suppose I shall have to let the water out of this in the fall, and have it empty all winter." "Oh, no," said the man; "you just get a piece of 4″x4″ or 4″x 6″, or any piece of wood, long enough so that its weight will keep it on the bottom of the hogshead, and throw it in. You never will have it burst, if it freezes solid. If a thaw should set in, you want to drive the stick down, so that the end will be on the bottom when the melting ice raises up."

We had no faith in it, but thought we would risk a bottom, so we put in a stick 2″x3″ or 3″x4″, I have forgotten which. The upper end rested on one side, and the lower wherever it happened to strike. When winter came, the hogshead froze solid, the ice bulged up in a great hump all around the stick. Neither the bottom nor any of the staves started. We used that hogshead six or seven years, and it was all right then.

The only way I could explain it was that when the ice expanded the particles followed the lines of least resistance, and that being around the stick, as the large hump or mound around the stick showed. The stick must bear on the bottom of the tank or vessel, as I remember once I had a barrel I did not want to burst, so I put a broom handle in it. The water froze solid, and did not burst the barrel. A thaw came on and I forgot to drive the stick down; then it froze solid again and out came the bottom.

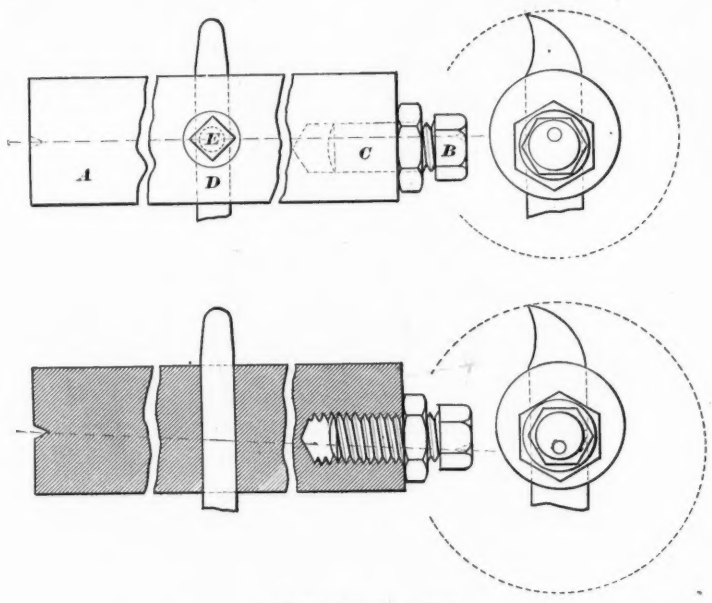
I examined the ice, and the stick was only one-half inch from the bottom. In very large tanks I think there should be two or three sticks, to allow the expansion to take place around. Still, one large stick will do it, but it will be harder work to drive down when a thaw comes. B. S.

Chicago, Ill.

A New Boring Bar.

Editor American Machinist:

As the subject of boring bars is being discussed in your valuable paper, I send you a drawing of my design.



A New Boring Bar.

It consists of the bar *A*, in the end of which is the bolt *B*, put in $\frac{3}{16}$″ out of the center of the bar. In the head of the bolt *B* there is a center in line with the bar *A* (that is to set the bar true when you want it so); turning the bolt *B* causes the bar to run eccentric, raising the tool *D* from the center and causing it to bore the hole larger. The check-nut *C* holds the bolt *B* in place. *E* is a bolt holding the tool in position, or a key might be used instead.

I have used this bar and prefer it to driving the tool with a hammer, especially when cutting *V* threads. With a little practice the proper cut can be given, while with a hammer we do not know how much we move the tool.

Of course any distance may be taken for the eccentricity. I have taken $\frac{3}{16}$″ because that is the distance on the bar I have used. But I think less eccentricity would be better in most cases. F. E. Valiquet.

A Foundry Hint.

Editor American Machinist:

It sometimes happens that a tradesman, no matter whether he be identified with the iron or wood-working interest, meets with men who have many suggestions to make, and ideas to offer, which in a number of cases are quite amusing, if not instructive. Of these I wish to speak. The shop with which the writer is connected has the usual foundry attachment, which of late has been the field of many a "blow," owing mainly to a lack of affinity between the cores and hot iron. The greater proportion of work being done requires a core varying in size from one to three feet in length, six inches in width, and one and three-eighth inches thick, vented at diagonal corners. The core mix has varied from seven parts of sand to one of rye meal, or one to nine of flour, along the scale, down to twenty to one of flour and sour beer *ad. lib.*, finally reaching sand and molasses only. Of necessity the more flour the more smoke, and one of the moulders, a man of extremely sensitive temperament, was thereby much inconvenienced, and sought a remedy. He found it in the shape of the following suggestion: Lay a gas pipe, or rather a net-work of pipes, along the foundry floor—have an uptake pipe and burners of a number equal to the number of flask vents; as the flasks are poured off, turn on the gas, light it, and away goes the smoke. The idea being novel, I lay it before your readers, thinking that its adoption might make things in the foundry go easier, especially on a foggy day. The one or two little objections to it are the pipes sticking up all over the floor to the number of 400 to 500; the liability of Jim running against them while carrying a ladle of hot iron, and a consequent accident; the time of turning on the gas and its usual get-in-its-work at the meter; the breaking of pipes, etc., would, to the progressive moulder, count as nothing if there was an abatement of the smoke nuisance.

"Old Sandy" thought he could improve on the scheme, and the following night just simply put a piece of sheet-iron against the flask, directly in front of the vent, which took care of the smoke most effectually, and, as a consequence, he has been solid with the boys in the foundry ever since.

Either idea is open to the fraternity, and although we shall not put in the pipe system *at present*, we should be glad to hear from any poor smoked-out shop that does adopt it, as it would undoubtedly prove a blooming success. Granger.

Boiler Feeding—That Stick in the Tank.

Editor American Machinist:

It seems to me that good practice now a-days means to get a given number of horse-power from the least amount of water evaporated, and least number of pounds of coal burned. Now, if this be the case, to do this we must use all diligence in arranging our plant, and especially the supply to boiler. Referring to Q. & A. column, Question 36, J. W. asks if it is a good plan to feed at the top. Let's see: If we feed at the top we must extend our pipe through the steam space of our boiler. We are apt to feed water of lower temperature than that of the steam. Then passing through this space will condense a certain amount around this pipe, then we discharge on our sheet-iron turned up all around to protect our flues, but at the same time forming a current of this cool water from discharge to the top of water line, which will naturally cause cooling at the top, and at the farthest point from the fire. This will necessitate the use of more fuel to create the required temperature.

Now, I think if J. W. will put on his thinking cap for a few minutes, and compare his way of feeding with the one I would suggest, he will prefer the latter. Feed through a stand pipe which shall reach the shell about three-fourths of the distance from fire wall to end of boiler; this will make a good heater after entering, then extend your pipe up inside two or three inches, put on an elbow with a short piece of pipe open towards front of boiler, then you have your cool current, where you will receive the heat more direct. I think he will get better results with less coal and water, and work dryer steam.

Mr. Lee Whitaker, in Question 52, can save his tank to a certain extent by putting a stick in the center of it; but if the water should be allowed to freeze to a very great depth, then it will fail. The stick will act as a buoy, and the ice will bulge up around the center instead of pressing on a straight line across the tank. S. E. Lewis.

[In feeding a boiler at or near the top, it is not necessary that the feed-pipe pass through the steam space. It is entered at one end, and passes along below the usual water line].

Mounting Drawing Paper.

Editor American Machinist:

Your article in the Feb. 7th number about mounting drawing paper prompted me to write to you of a method of stretching paper practiced by myself, and probably by many others. I generally buy from some chemist a half pound of dextrine (powdered) which only costs ten cents, and lasts me six months or so. For a drawing, 3 feet by 2 feet, use $\frac{1}{2}$ teaspoonful of dextrine with the addition of enough cold water to make a thin paste. I fold over a margin of one inch of my paper, dampen the side opposite that upon which I wish to draw, and with a piece of flat stick apply the dextrine to the margin. I then press the margin to the board, slightly stretching the paper as I do so. When the drawing is finished I cut it inside of the margin, and remove the latter by inserting the blade of a knife between it and the board, and simply peeling it off. It comes away as slick as a whistle, leaving the board perfectly clean. That's why I like it. Geo. H. Stagen.

Protecting Draftsmen's Eyes.

Editor American Machinist:

Much of the strain on the muscles of the eyes, caused by close work, like drawing, as explained in your recent article on the subject, may be avoided by the wearing of spectacles, the lenses of which are prisms, the effect of which is to allow the eyes to remain nearly in the same position while looking at the drawing board as they would be when looking at a distant object without the glasses. Of course, an oculist should be consulted in order that the glasses may properly fit. No one should wear glasses of any kind that have not been prescribed by some competent person, as the eye is about the last thing to be fooled with. Draftsman.

A Protest by Engineers.

It is rather a dull day when no new scheme is developed for making money without any very hard work, except that which is done by others not in the scheme, whose labor is of course very necessary to the success of the enterprise. The organized engineers of this city have made a formal protest to the authorities against the operations of a company whose plan seems to be to contract with the owners for the management of steam plants at rates for which competent engineers cannot be employed, and then, in order to make profits upon the service, employ incompetent men utterly unable to obtain licenses, and compel them to act not only as engineers, but as firemen, steam fitters and general roustabouts.

One of the methods made use of by this enterprising company is said to be to report a boiler as "out of use," and thus avoid the necessity of applying for a license. An instance is given of a boiler reported "out of

use" which exploded, killing the engineer. It is claimed that the steam heating apparatus of the school buildings is in the hands of utterly incompetent men. The engineers ask that this state of affairs be remedied, and it is certainly in the interest of owners of steam plants and of the public, as well as of the engineers, that it should be remedied, and that speedily.

Shop Notes.

AN AMERICAN MACHINIST man called at the works of E. E. Garvin & Co. a few days ago, and found them making preparations to move into their new quarters at Laight and Canal streets, this city. The new building will be much superior and better adapted to their business than the one they have occupied for some years at 139-143 Centre street.

The new building contains six floors besides the basement, comprising in all about forty-five thousand square feet of floor space, or more than twice the amount they have heretofore occupied.

The building is accessible on three sides from as many different streets, and is well lighted and ventilated.

In the center of the basement is the engine-room, which contains a 100 horse-power Whitehill-Corliss engine, from which a vertical belt runs up to the line shaft on the second floor. By belting from this shaft up and down to the others on the floors above, short belts are avoided. Friction pulleys and couplings are to be used, so that any line of shafting can be disconnected at will. A separate engine runs the elevator. In the rear part of the basement the blacksmithing and tool dressing will be done, while forward of the engine room will be the counter-shaft department. The space under the side-walks will be utilized for the storage of coal along the side of the building; that in front being used for the case-hardening furnaces, and in the back for the racks for tool steel. The ground floor will be used for the offices, which will be elegantly fitted up, and for the storage and exhibition of finished machinery.

The next floor above will be used for planers and milling machines. Above this will be the lathes and miscellaneous tools, above which will be the assembling room. The walls are all plastered, and all the floors ceiled overhead. The drawing room will be in the fifth story, the pattern makers' room in the sixth.

The building will be steam-heated, and everything is to be first-class throughout. The fact that the Sixth avenue elevated railroad runs within a block of the building, and cross-town street car lines also run quite close to it, make it easily accessible from any part of the city.

E. E. Garvin & Co. and the men employed by them may well be congratulated upon the change.

The Equalization of Lead and Cut-off in Slide Valve Engines.

BY FREDERIC A. HALSEY.

SECOND PAPER.

II. Obtaining an exactly equal cut-off in engines with fixed eccentric, without disturbing the equality of the lead.

Throughout this section one fundamental fact must be kept in mind, viz.: The acts of opening and closing a port by a slide valve differ only in the direction of motion of the valve. The port is opened or closed, as the case may be, by the edge of the valve passing the edge of the port, and the position of the valve when cut-off takes place is the same as when admission takes place. Since the valve is mechanically connected to the eccentric rod pin, it follows that the position of that pin must be the same at cut-off as at admission.

Let it be proposed to design a slide valve to cut off steam at half stroke, with equal lead and cut-off.

Strike the crank and eccentric circles of Fig. 6. Locate points *A*, *B*, the positions of the crank-pin, for admission of steam, and the corresponding positions *a*, *b* for the eccentric center, the rocker to be used being of the first type. With radius equal to the length of the connecting rod, and with center at the middle position of the crosshead pin, strike arcs cutting the crank circle at *c* and *d*. Before cut-off in the forward stroke, the crank-shaft, and with it the eccentric, must turn through the angle *A c*, and in the return stroke *B d*. Space off *a' e* equal to *A c*, and *b' f* equal to *B d*. Draw *e g* and *f g*, and we have point *h*, where the eccentric center must be for cut off at *c*, and *i* where it must be for cut-off at *d*. With radius equal to the length of the eccentric rod, and with centers at *b*, *i*, strike arcs meeting at *k*, and with same radius and centers *a*, *h*, strike arcs meeting at *l*. Now for admission at *A* and cut-off at *c*, the eccentric rod pin must be in the same position, and as the eccentric rod is of fixed length, this position must be *l*, that being the only point whose distance from both *a* and *h* equals the length of the eccentric rod. Similarly for admission at *B* and cut-off at *d*, the pin must be at *k*. The pin can be brought to these positions at the proper time by locating the rocker fulcrum at any point *o*; such that an arc struck from it shall pass through *k* and *l*. The valve stem should then be connected to the rocker, as shown at *m n*. The eccentric rod positions for crank positions *A*, *B* are shown at *a l*, *b k*. The rocker fulcrum might be located above the center line, if preferred, at *o'*.

Fig. 6.

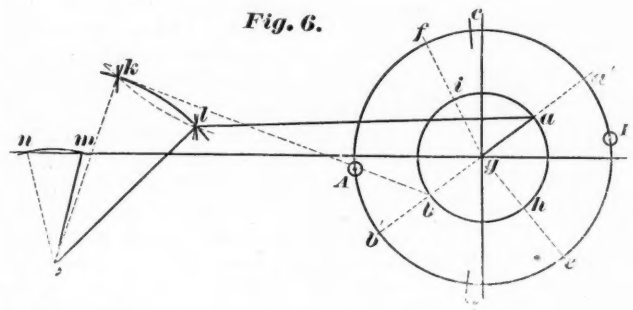


Fig. 7.

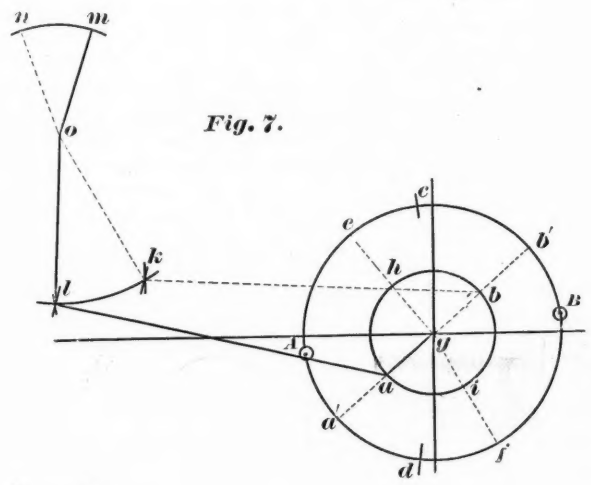
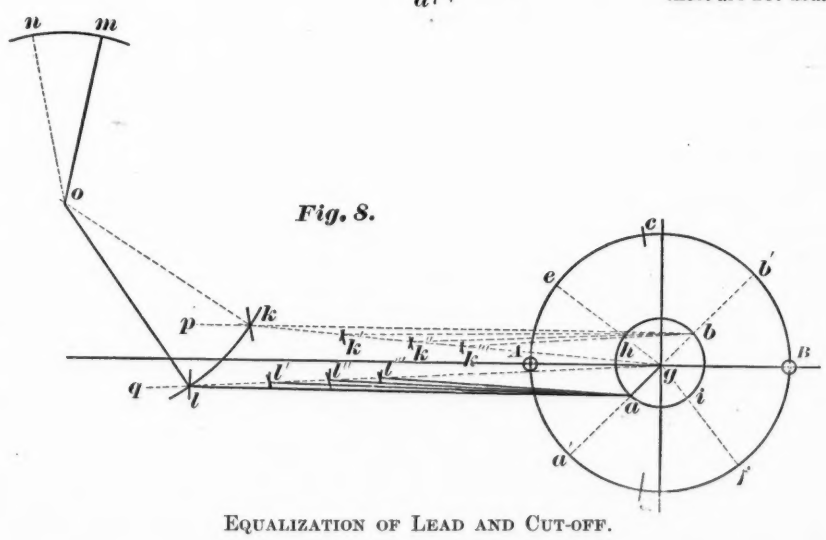


Fig. 8.



EQUALIZATION OF LEAD AND CUT-OFF.

For the second type of rocker the construction is essentially the same as shown in Fig. 7, which is lettered to correspond with Fig. 6; and it is recommended that the description of Fig. 6 be re-read, but referred to Fig. 7.

We have thus found a mechanism which accomplishes the second object, "obtaining an exactly equal cut-off in engines with fixed eccentric, without disturbing the equality of the lead."

III. Obtaining a practically constant and equal lead, and a practically equal cut-off in shifting eccentric engines, by a method which at once fulfills the conditions of I and II.

Referring again to Fig. 3 of the first paper, it appears that the fundamental principle of its construction is the diminution of the inclination to one another of the lead positions of the eccentric rod, and, referring to Fig. 6, it appears that the fundamental principle of its construction is the direct reverse of this, *i. e.*, the increase of this inclination. It hence appears at once that the constructions of Figs. 3 and 6 are incompatible, and cannot be reconciled with one another. Comparing Figs. 4 and 7, on the contrary, it appears that in this general way they agree, but while in Fig. 4 the inclination of *h c* and *i d* is reduced to actual zero, *i. e.*, the rods are made parallel, in Fig. 7 *a l* and *b k* are still inclined at an appreciable angle. Now the inclination of *a l* and *b k* to one another in Fig. 7 can be varied at will by changing the length of the eccentric rod, and by choosing a proper length they can be made parallel, and the proportions so found will satisfy the construction of I, and for the particular grade of expansion for which the construction of Fig. 7 should be drawn of II likewise. For other grades it will, of course, satisfy II only approximately. One qualification must, however, be made. In Fig. 4, *A* and *B* are located at the dead points, while in Fig. 7 they are located at the points where admission occurs, and these are not usually the dead points. It will simplify matters to make these points coincide by considering, in the first instance, an engine with a lead of zero. In Fig. 8 the construction of Fig. 7 is repeated for the mean throw of the eccentric and with lead zero, but with several lengths of eccentric rod, giving a corresponding number of points *k' k'' k''', l' l'' l'''*. It is plain that the inclination to one another of *k' b*, and *l' a*, is less than that of *k'' b*, and *l'' a*, which in turn is less than *k''' b* and *l''' a*, the degree of inclination depending on the length of rod used. If a length of rod can be found such that its two positions shall be parallel to one another, the rod so found will obviously satisfy both I and II. This length is found in the following manner: It is obvious that all the points *k' k''*, etc., are on the straight line *p g*, and similarly *l' l''*, etc., are on *q g*; therefore, draw *p g* and *q g*. Assume a trial length of eccentric rod, and with centers *a*, *b*, strike arcs giving *k*, *l* such that *b k* and *a l* are parallel, repeating the construction with different lengths of rod until the correct length is found. Locate the rocker fulcrum so that the eccentric rod pin shall pass through *k* and *l*. Now positions *a l*, *b k*, obviously satisfy II, and, being parallel, they also satisfy I, and an engine with its valve motion laid out in this manner will have the approximately equal and constant lead of I, the equal cut-off of II for that eccentric throw for which the construction is made, and an approximately equal cut-off for other positions of the eccentric.

Communication Regarding Evaporation of Horizontal Flue Boilers.

Editor American Machinist:

An article in your issue of February 14th, taken from the Montreal *Daily Witness*, on the test of the "Field-Stirling Boiler," says:

"Mr. Snow, the general superintendent of the Standard Oil Company, who has probably more boilers under his control than any other man on this continent, stated recently that the best result he ever obtained, under the most favorable conditions, with the ordinary horizontal tubular boiler, was nine pounds of evaporated water to a pound of combustible, and that the average result with these boilers will not exceed seven and a half pounds . . . ."

The horizontal boiler of Mr. William Low, of Bridgeport, Conn, at the International Exhibition at Philadelphia in 1876, in the economy trial evaporated 11.923 pounds of water for each pound of combustible, and superheated the steam 9.457 degrees and developed 46.96 horse-power. And in the capacity test it evaporated 11.163 pounds of water for each pound of combustible, superheated the steam 9.888 degrees, and developed 69.25 horse-power.

In October, 1888, Mr. George H. Barrus made a commercial test of two horizontal flue boilers erected under the patents of the writer, with the following results:

ITEMS.	Lykens Valley Buckwheat Coal.	Lowery's Schuylkill Pea Coal.	Gigg House Washed Pea Coal.
Pounds of water evaporated per lb. of coal.	8.999	9.10	9.213
Pounds of water evaporated per lb. of combustible.	11.381	11.071	11 305
Suction draft of chimney, height of col. of water sustained in inches.	0.16	0.24	0.27
Steam pressure per gauge (average)	87.3	85 5	86.4
Horse-power developed	178.3	194.6	188.7

The heating surface of each boiler was as follows:

Square feet of water-heating surface, 934
Square feet of steam-heating surface, 107
Total square feet of heating surface, 1,041
Square feet of grate surface, 32

Had the chimney been properly constructed there is no doubt but twelve pounds of water would have been evaporated per pound of combustible. The writer has over fifty boilers of his improved make and setting in use, that average *eleven pounds'* evaporation per pound of combustible.

Assuming the accuracy of the statement attributed to Mr. Snow, as quoted from the *Daily Witness*, it is evident that the boilers employed by him are far below the average of horizontal flue boilers in efficiency. In other words, they are not up to the standard of "ordinary" boilers of this class, and are greatly inferior to the *best* of those constructed and set up on this plan.

WM. BARNET LE VAN.

Philadelphia, Pa.

The binding twine trust, which has for four years controlled the sale of twine used by western farmers for binding grain, has already raised the price from 12 to 18 cents per pound, and proposes to make a further advance to 20 cents. The farmers are getting tired of this, and are getting signatures to a pledge not to bind their grain unless the price of twine is reduced. Pity they could not find a substitute for twine, as the cotton raisers did for jute bagging. We hope some ingenious inventor will help them out of their trouble, to the discomfiture of the greedy trust.

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, MARCH 14, 1889.

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Captain John Ericsson.

Capt. John Ericsson, the illustrious mechanical engineer, to whom this, his adopted country, and indeed the world, owes so much, died at his residence in this city, March 8th. Capt. Ericsson was born July 31, 1803, in the province of Wermland, Sweden, coming to this country in 1839.

At the age of ten his ingenious constructions of machinery attracted the attention of those who were in a position to help him to attain to that eminence in the profession to which his talents entitled him, and at twelve years of age he was made a cadet of mechanical engineers. At thirteen he was made a leveler on the ship canal intersecting the Swedish peninsula. He afterwards entered the Swedish army, being promoted to a captaincy at the time of his resignation in 1826.

It was in this year that he left his native country, to which he never returned, though from it he has received many honors and decorations. The intervening time, from 1826 to 1839, was passed in England, where he invented a large number of notable engineering devices, the most prominent of which were an instrument for taking soundings, which is still used, a pumping engine, a rotary steam engine, and a system of artificial draft for steam boilers. In 1828 he applied the principle of condensation to the engines of the steamship "Victory," and a few years later introduced on another vessel centrifugal fan blowers, which are now generally used in American steam vessels. In 1830 he applied the link motion to two locomotives, and in 1834 he superheated steam in an engine on the Regent's Canal Basin. In 1829 he constructed a locomotive which competed with Stevenson's Rocket for a prize offered by the Liverpool and Manchester Railway, and ran at the then amazing rate of 30 miles an hour. Though the Rocket was the victor on account of superior tractive power, Ericsson's engine was conceded to be superior in many other points.

His famous caloric engine was produced in 1833, and immediately attracted the attention of the scientific world. Twenty years later, a ship called the "Ericsson," propelled by one of these engines, made the voyage from New York to Washington and return. Though the results of this trial showed that the engine could not compete with steam on a large scale, the principle has since been applied to smaller engines, thousands of which have been built for minor useful purposes, where small amounts of power are required.

The second bestowal of the Rumford medal in this country was awarded to him by the American Academy of Arts and Sciences. In 1837 Ericsson built a tugboat which was driven by the first screw propellers; two of them being used. The British Admiralty, after being towed in their barge by this tug at a rapid rate, condemned it because the motive power was in the stern, and consequently the vessel could not steer!

In 1841 he began the construction of a vessel called the "Princeton," which was the first to carry her machinery entirely under the water line, thus protecting it from shot. This vessel brought about a reconstruction of the navel fleets of the world, and included, besides the improvements already mentioned, a direct-acting engine of great compactness, a fan blower in the hold, a gun carriage having devices for taking up the recoil, telescopic smoke-stacks, and a self-acting lock which automatically discharged the gun when the desired elevation was reached, independent of the rolling of the vessel.

The invention with which his name is most frequently coupled by Americans, however, is that of the "Monitor" turret ship, which not only changed the whole course of our civil war and prevented foreign intervention, but brought about the second revolution in naval architecture due to his genius, the history of which is familiar and needs no repetition.

Capt. Ericsson himself wrote an article upon this vessel, which was published in the *Century* for December, 1885.

His latest invention in this line is the "Destroyer," which he believed able to cope with any naval vessel afloat.

Gifted with a remarkably strong constitution and great natural energy, he remained active up to within a few days of his death—among his last spoken words being an expression of regret at leaving some engineering work upon which he was engaged uncompleted.

It would be impossible within the limits of such an article as this to even mention all of his notable inventions and discoveries for which civilization is immeasurably indebted to him.

Many honors have been bestowed upon him by various governments and scientific societies. He received the thanks of Congress, and was a member, active or honorary, of many scientific associations in America and Europe, including the American Society of Mechanical Engineers.

"An Interference."

Nearly twelve years ago an application was made by a man named Berliner, for a patent involving the right to the use of an essential part of the telephone transmitter. During the most of the intervening time to the present day it has been "in interference" with a similar application made by Edison, the only apparent reason for the long delay in settling the matter being that the Bell Company had bought the claims of both parties, and did not want the matter settled and a patent issued until near the time for other patents which they now hold to expire. It seems that the rules of the office are such that when this company secured the claims of both Berliner and Edison and began to play both sides of the game, they could delay a decision in the matter of interference as long as they chose, the Commissioner of Patents declaring when this matter was brought to his attention that he could not prevent such collusive delay. The Bell Company by this trick (for it was nothing more) was enabled to monopolize the telephone business during the term of their first acquired patents and at the same time keep alive another bottom patent which, now that the time for the expiration of the first patents draws near, they have graciously permitted the Board of Examiners to pass upon.

The board, it seems, has decided in favor of the Berliner application, though that is a matter of no importance whatever for the decision is and of necessity was bound to be in favor of the Bell Company, whether decided nominally for Berliner or for Edison, and the value of the decision to the company was enhanced by the delay, by an amount just equal to what they can compel a long-suffering public to pay during the extension of time, for what has now become a business necessity.

Another curious feature of this business is that, at the recommendation of the Commissioner of Patents, bills were introduced into Congress designed to put an end to such practices, and, so far as known, those bills have never been heard of since, though sufficient time has elapsed since their introduction to have passed them through a dozen times over had there been any politics in them. This naturally makes one think of the connection there might possibly be between the money of the Bell Company and the negligence shown by the congressional committees in the matter. It is such performances as this that strengthen unreasonable opposition to the entire patent system; and if honest and deserving inventors are ever deprived of part of the protection in the use of their inventions which they now enjoy, it will be chiefly due to such tricks played by wealthy corporations.

Two Hundred a Year for Liquor.

An item which has started the rounds of the press, and which will probably be very industriously copied until something more malignant is furnished to take its place, is extracted from a recent article in the *Forum*, which states that, "It is safe to estimate the receipts of the New York saloons at $30,000,000 a year, one-half of which at least comes from 150,000 men who are known as laboring men. . . . . The destruction of the liquor saloons alone would cure four-fifths of the poverty in the community." It is of course unnecessary to call the attention of the writers of such stuff to the fact that the first statement is utterly unreasonable and will not bear investigation for a single moment, and that the second one is directly contradicted by economic science as well as daily observation. The figures quoted would make the laboring men of New York spend an average of $200 a year for drink. We assume, of course, that the term "laboring men," as here employed, includes mechanics, and in fact all who perform manual labor. We have some personal acquaintance among such men, and feel very confident that, if the writer of the *Forum* article had an equally extensive acquaintance with them, he would know that the workingmen do not spend an average of any such an amount for such purpose, nor anywhere near it, and for the simple reason, if for no other, that they have not got it to spend after paying for what is necessary to sustain life in this expensive city.

If this writer and others who write articles for the high-priced magazines, telling their readers what is the matter with the "laboring man," would take the trouble to investigate and find out what kind of a living many of them who are absolute teetotalers are able to secure in return for their labor in our large cities, they might find reason to modify their opinions somewhat, and to conclude that the discouragement born of hopeless poverty and deprivation is responsible for four-fifths of the intemperance among them.

This is not saying that there is not more drinking among workingmen than there ought to be and more than is good for them, but to charge four-fifths of their poverty to that cause is a flagrant injustice, and such writing only tends to prevent the bringing about of a better condition of affairs. The liquor drank by others has more to do with keeping laboring men poor than that which they themselves drink.

If we may believe the reports, the Paris hotel keepers are preparing to cut their own throats, metaphorically, during the continuance of the Exposition, just as those of Vienna did in 1873. Exorbitant hotel charges will do wonders in the way of preventing the success of the Exposition.

At a meeting of the Wagon and Carriage Makers' Association at Pittsburgh it was resolved to advance prices, notwithstanding business was said to be dull.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(115) R. S. B., Binghamton, N. Y., asks: Please explain the manner of reading the graduations on a draftsman's scale, or refer me to a good work which treats on this subject. *A.*—You will find the desired information in our issue of February 5, 1887. There we have illustrated the scale, and have endeavored to give as plain an explanation as possible.

(116) F. C., San Jose, Cal., asks: 1. What chemical can I put into water to find if it contains salts of lime? *A.*—Fill a test tube half full of the water, to which add a teaspoonful of aqua ammonia; then add 15 to 20 drops of oxalate of ammonia. If salts of lime are present the water will become turbid. 2. What compound do you consider best to use in a boiler? *A.*—It depends upon the kind of water. It is a question that should be submitted to some one with a knowledge of chemistry. 3. Is there any simple way of analyzing water? *A.*—No.

(117) A. U. L., Pittsburgh, Pa., asks: What is the preparation used for writing white on blue prints? *A.*—There is a preparation made for the purpose; the kind we use is called "Hello's Erasing Fluid." If you cannot obtain this fluid in your locality, then dissolve a little washing soda in water, and use it; this solution will not make as clear lines as the erasing fluid referred to. 2. Does

the patent law require that a patented device shall be marked "Patent," or in any other way so as to show that it is patented? *A.*—It should be marked "Patented," and follow with date.

(118) "T," Ft. Worth, Texas, writes: The main bearing of my engine, though in good adjustment and well lubricated, runs warm. It is 9½x17 inches, and supports half the weight of the fly-wheel and crank-shaft, or about 14,000 pounds. The stroke is 4 feet, revolutions 78, running under, pulling 250 horse-power. The belt slants down from fly-wheel at an angle of 37°. Is the bearing of sufficient size to insure cool running, or is the trouble somewhere else? *A.*—We think the bearing is of sufficient size, and that the trouble must be looked for elsewhere. Perhaps the shaft is worn out of round, or the babbitt of the bearing not in good condition.

(119) J. S. S., Philadelphia, Pa., asks: 1. Please recommend to me some book in which I can find detail drawings of stationary engines, so that I may study them. *A.*—There are many good books in which detail drawings of stationary engines may be found; probably the Practical Treatise on the Steam Engine, by Arthur Rigg, may answer your purpose. 2. Please name good books on gearing. *A.*—Treatise on Gears, by G. B. Grant; Kinemetics, by C. W. MacCord; Practical Treatise on Gearing, by Brown & Sharpe Mfg. Co.; and others. 3. Can you give me a rule for laying out the sheets for boilers so that, after punching and rolling the sheets, they will be of the correct form? *A.*—Follow the articles on "Practical Drawing," now running in the AMERICAN MACHINIST. 4. What is the price of all the issues of the AMERICAN MACHINIST, containing the articles on "Practical Drawing"? *A.*—Five cents each.

(120) B. S., ———, writes: I have a boiler which leaks very much along the seams. Can you give me a receipt for an elastic cement which I can use to stop the leaks? I also want to raise the hand holes about four inches and fill up with cement. I have tried Portland cement, but find it does not expand with iron when the boiler gets hot. *A.*—There is no cement for the purpose of stopping leaks in a boiler. We should advise you to send for a first-class boiler maker at once, and let him examine the boiler. The leaks may or may not be at the seams; they are indications that there is something wrong with your boiler, and may be warnings of great danger. If, through your negligence, or through your trifling with the boiler, it should explode and occasion loss of life, you will be, and justly so, held responsible for the results.

(121) J. G. H., Brooklyn, N. Y., asks: 1. Do you know of any government that has offered a reward lately for the invention of a perpetual motion machine, and if so how much? *A.*—A perpetual motion machine is an impossibility; such a machine cannot and never will be made. We have not heard of a government offering a reward for such a machine, and we believe it is safe to say that governments never will offer a reward, and will not even take the trouble of examining a device of this kind; the name is sufficient to condemn it. 2. If a man has invented such a machine, where must he apply to get it on the market? *A.*—In some junk shop. 3. If a person has invented a ship which cannot sink, even if it is totally ruined, where shall he apply to get it in use? *A.*—Apply to any ship-builder of good reputation.

(122) J. S. C., La Crosse, Wis., writes: The wheels of our band-saw are made of cast-iron. Each has 16 arms, section of arm is an ellipse, the axes of which are 1⅜ and 3¾ inches; rim 2x8¼ inches. Face of wheel is covered with wooden lagging, made up of maple cants, laid up in glue and fastened with wrought-iron nails, and after it is bored out it is tightly forced onto the rim of wheel. Lagging is three inches thick. Finished wheel is nine feet diameter. It makes 322 revolutions per minute. I wish to know if we can safely increase its speed. *A.*—No; we would prefer a slower speed. 2. In computing the resistance a wheel will offer to the centrifugal force, is the strength of the rim taken into account, or only the strength of the arms? *A.*—Generally the strength of the rim only is taken into account.

(123) E. R. H., Oakland, Me., writes: I am building an engine for a steam yacht and want it run as fast as practicable. Two cylinders, 3½x4 inches, non-condensing. The steam ports are 5-16x2 inches. Are they large enough? *A.*—Yes. 2. The valve has ¼ inch lap, no inside lap; travel of valve, 1¼ inch. Is this right? *A.*—Yes; the proportions of the valve and ports are good. 3. I want for this engine a steel upright boiler with submerged head; what will be the dimensions of one that will carry a safe working pressure of 150 pounds, and can I make the upper or receiving chamber straight? If so, what must be the distance between this chamber and the outer shell? *A.*—Diameter of outer shell, 40 inches; height, 90 inches; diameter of fire-box, 34 inches; height, 48 inches; number of tubes, 42; diameter, 2½ inches. The water space between the outer shell and the receiving chamber should not be less than 2½ inches. We believe a conical receiving chamber will be better than a straight one. The given dimensions of boiler are for a forced draft; for natural draft you will require a larger boiler.

(124) G. T. C., New York, sends a sketch of a train of wheels; on the first shaft, which is turned by a crank of 20 inch radius, is a pinion having 16 teeth. This pinion engages with a gear having 50 teeth, which is upon an intermediate shaft. This intermediate shaft has also a pinion of 30 teeth engaging with a gear having 60 teeth which is upon the third shaft. To the crank a force of one pound is applied, and it is made to turn 10 revolutions per minute. He asks, what power is produced at the third shaft, and the foot pounds of work, no allowance being made for friction? *A.*—The foot pounds per minute applied to the crank are equal to the circumference of the circle traveled by the power (125.66 inches) × the number of revolutions per minute (10) or 1256.6 foot pounds per minute. Disregarding friction and other external resistances, the foot pounds delivered by the third shaft will be precisely the same, and this would be the case regardless of the number of wheels intervening, or their proportions. A clear distinction should always be made between *power* and *force*. They are not synonymous mechanical terms. The power developed at the third shaft (disregarding friction) is precisely the same as that which is applied to the crank, but the *force* will be greater. To find this force, multiply the number of teeth in the driven wheel together, and divide this product by the product of the number of teeth in the drivers. The result is 6, and under these conditions a crank of 20 inch radius attached to the third shaft would be in equilibrium when acting against a resistance of six pounds.

(125) J. S., Newark, N. J., writes: Please give me the rule by which I can ascertain the amount of lap necessary on the steam side of a slide valve to cut off steam at various fractional parts of the stroke? *A.*—The manner of finding the lap for any slide valve has been thoroughly explained and illustrated in our issue of Nov. 21, 1885; we believe it will give you all the desired information. 2. Please give me a rule for finding the mean pressure on the piston when the initial pressure is given. *A.*—See Indicator Diagram, by F. F. Hemenway, in our issue of February 16, 1884. The mean pressure can also be found when the initial pressure and ratio of expansion is known. Thus: Suppose it is required to find the mean pressure when the initial pressure in the cylinder is 85 pounds per square inch; stroke, 24 inches; cut-off at 6 inches. The pressure here given is that which is indicated by the steam gauge. The steam pressure indicated by the steam gauge is always less than the absolute pressure; the difference is 14.7 pounds; for practical purposes we may say it is 15 pounds. In calculations of this kind we must always use the absolute pressure, hence, the absolute pressure in our example is 85 + 15 = 100 pounds. Dividing the length of the stroke by distance of the point of cut-off from the beginning of the stroke, we obtain the ratio of expansion, thus: $\frac{24}{6} = 4$, which is the ratio of expansion. Looking for this (4) in a table which gives the value of hyperbolic logarithms added to 1, we find alongside of (4) a value of 2.386. Multiplying this by the steam pressure, we have 2.386 × 100 = 238.6. Dividing this by the ratio of expansion, we have $\frac{238.6}{4} = 59.65$, which is the mean pressure in pounds per square inch of steam of 100 pounds absolute pressure cut off at one-quarter stroke.

(126) C. A. W., ———, asks: 1. Is the pitch of a gear wheel the distance from the center of one tooth to the center of the next on the pitch line? *A.*—Yes, except in the case of diametral pitch, which is commonly expressed in the number of teeth for each inch of pitch diameter. 2. How shall I find the pitch of a gear? *A.*—If the diametral pitch is wanted add 2 to the number of teeth and divide by the whole diameter. If the circular pitch: Divide the circumference of the pitch circle by the number of teeth. If chordal pitch: Divide 180° by the number of teeth. Take the sine of this angle and multiply it by the pitch diameter. This formula is

$$P = \text{Sine of } \left(\frac{180^\circ}{n}\right) \times D$$

3. Please give me a rule for computing the correct diameter for a gear blank, the pitch and the number of teeth being given. *A.*—If you want to figure the pitch diameter from the diametral pitch, the rule is

$$D = \frac{N}{P}$$

where D = the pitch diameter, N = the number of teeth in the wheel, and P = the pitch. Example: Required the diameter of a gear having 45 teeth, 8 pitch. 45 ÷ 8 = 5⅝ inches, the pitch diameter of the wheel. If circular pitch is used the rule is

$$D = \frac{P\,N}{3.1416}$$

Example: Required the diameter of a gear having 45 teeth ¾ inch pitch. 45 × ¾ = 33.75 ÷ 3.1416 = 10.743 inches. If the chordal pitch is used the rule is

$$D = \frac{P}{\left(\frac{180^\circ}{N}\right) \text{sine}}$$

Example: Required the pitch diameter of a gear having 45 teeth ¾ inch pitch. 180° ÷ 45 = 4°, the sine of which is .0698 and ¾ ÷ .0698 = 10.745 inches. 4. Do you think the steel in a locomotive tire would be sufficiently good to make taps and reamers of? *A.*—No. 5. Is one end or both of a mariner's compass needle magnetized, and should it be of iron or steel? *A.*—Magnetic needles are made of steel, and are magnetized throughout. 6. What is the reward offered by our Government to the person who succeeds in tempering copper? *A.*—No reward has ever been offered, that we are aware of. 7. Has anyone to your knowledge ever succeeded in making it any harder than it may be made by hammering? *A.*—It is said to have been made much harder by a method practiced in pre-historic times, but the art has been lost. 8. How many feet per minute should a milling cutter run cutting steel, the cutter being about ⅝ inch wide on the edge? *A.*—It will depend somewhat upon the character of the steel worked and the depth of cut. Under average conditions, with abundance of lard oil it may run 40 to 50 feet, though the speed can be properly determined only by the exercise of judgment in each particular case, and this judgment must be based upon experience.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue

Gear wheels and g-cutting. Grant, see adv., p. 16.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Duplex Gear Cutters. R. M. Clough, Meriden, Ct.

Colliau Cupolas, etc. A. E. Jenkins, Scranton, Pa.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Berryman Feed-Water Heater and Purifier. Benj. F. Kelley, 91 Liberty street, New York.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

"Swift" Sight Feed Lubricator; no glass tubes; simple, reliable. Swift Lub'r Co., Elmira, N. Y.

Power measured with guaranteed Dynamometers. Franklin Van Winkle, 91 Liberty st., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

Round Adjustable, Round Solid, and Square Dies, all sizes. Mfd. by S. W. Card & Co., Mansfield, Mass.

Fire Brick and Clay Retorts; large variety; special shapes to order. Borgner & O'Brien, Philadelphia.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Brown & Sharpe Mfg. Co. have a line of machinery with S. A. Smith, 23 S. Canal st., Chicago, Ill.

Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Automatic Wire Straightening and Cutting Machinery, Tools, etc. Manufactured by Collins-Gibbons Mfg. Co., St. Louis, Mo.

Upright drills, improved, sizes 21″, 23″, 25″, 28″, 32″, 36″ swing; finely made and great capacity. J. E. Snyder, Worcester, Mass.

Engine lathes, hand lathes, fine tools, files and supplies for machinists and other metal workers. Frasse & Co., 92 Park Row, N. Y.

"Curiosities of the U. S. Patent Office." A great book. Goes like hot cakes. 12 pp. pamphlet for stamp. *Get one.* W. C. Raymond, Syracuse, N. Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See March 7, p. 14. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Fine tools and supplies for machinists and other metalworkers. Get our prices before purchasing elsewhere. Montgomery & Co., 105 Fulton st., N. Y. City.

With my Vacuum System, Exhaust Steam Heating costs nothing for fuel; Live Steam Apparatus altered to Exhaust. Satisfaction guaranteed. Geo. A. Barnard, 15 Cortlandt street, New York.

W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches, working drawings for the transmission of power by steam, water, air and electricity.

Contract work of all kinds executed promptly and on reasonable terms. Parties wishing grey iron castings in large quantities can make money by corresponding with Rawson Mfg. Co, Hornellsville, N.Y.

The Vance Lightning Flue Cutter is *the* tool for removing old flues from boilers and locomotives (will cut fifty an hour); sent on approval to railroad companies. Vance Tube Cutter Co., Geneva., N. Y.

Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 90 years' experience. 230 pages, illustrated, 12mo., cloth, $2.00. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N. Y.

Patterson, Jordan & Gottfried, 146-150 Centre st., N. Y. Metals, Machinery, Hardware, Tools and Supplies for Machinists, Mills, Engineers, Brass Goods Mfrs., Factories, etc. An extensive assortment of Bolts, Screws, Wire, Taps, Drills, etc., carried in stock.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton St., New York.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including Feb. 14, 1889 issue, 70 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 84 articles have thus far appeared up to and including the Feb. 7, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

J. H. Miner is to start a machine shop at Baton Rouge, La.

The National Lathe and Tool Company, Camden, N. J., has been incorporated.

The Kentucky Central Railroad Co. are reported as to build shops at Paris, Ky.

The Lincoln Hay Press Co. has been organized at Lincoln, Neb., to build hay presses.

Taylor Brothers will enlarge their machine shop and foundry at New Orleans, La.

The citizens of Centralia, Ill., are raising money with which to assist manufacturers in locating there.

The Logan, Swift & Brigham Envelope Co., Worcester, Mass., expect to build a large factory in that city.

D. R. Kline has purchased the machine shop and foundry of W. C. Mount, at Gainesville, Ga., and will increase facilities for doing work.

The Enterprise Woodworking Company has been organized at Sheffield, Ala. Office furniture, sash, doors, blinds, etc., will be manufactured.

The Continental Steel Car Wheel Co. propose to erect works at Norristown, Conn. Steel wheels will be manufactured under the patents of T. W. Bean.

The Phœnix Railway Supply Co. is a new enterprise, with offices at 15 Cortlandt street, New York. The company propose to deal in all kinds of rail way supplies.

The Whittier Machine Company, Boston, Mass., will erect a building devoted to the construction of elevators. It will be equipped with tools especially designed for that purpose.

The Cleveland Twist Drill Co., Cleveland, Ohio, has issued a new and enlarged catalogue of twist drills, taps, reamers, cutters, etc. The catalogue is well arranged and illustrated.

The Van Dusen Gas Engine Company, Cincinnati, Ohio, has issued a circular illustrating and describing the Van Dusen gas engines. Several important claims are made for this engine.

A $90,000 stock company to manufacture woolen jeans and fine knit hosiery has been organized at Louisville, Ky., by Emby L. Swearingen and Harry T. Jefferson, who will start work within two months with 65 looms. They already contemplate enlarging.

There is water-works agitation at Russellville, Ky.; Goldsboro, N. C.; Wytheville, Va.; Monroe, Mich.; Fond du Lac, Wis.; Mount Holly, N. J.; Reading, Pa.; Fort Worth, Texas; Hopkinsville, Ky.; Lebanon, Pa.; Fostoria, Ohio; Wyandotte, Mich; West Cliffs, Col.; Medicine Lodge, Kan.

The Hoggson & Pettis Mfg. Co., New Haven Conn., has brought out an eight-jawed chuck, designed to get a stronger hold on work with less danger of springing than when a chuck with fewer jaws is used. The inside mechanism is the same as that employed in the other "Sweetland" chucks made by this company.

Julius L. Hornig has issued a pamphlet of his Direct Power Steering System (for steamships), by means of pneumatic, steam or hydraulic motor. His system is illustrated and explained, and comparisons are made, by means of illustrations, showing the small amount of space occupied by the Hornig apparatus as compared with that of other devices for the same purpose. E. S. Wells, Jersey City, N. J., is the manufacturer of the Hornig steering apparatus.

The Fort Worth *Gazette*, speaking of the contemplated cotton mill at Waco, Texas, says: The subscription books of the big cotton mill have been opened, and the stock is being rapidly taken. The projectors of the enterprise hope by next October to have the mill in operation, so as to consume a few of the 75,000 bales of cotton which are annually marketed here. There is no doubt but that the mill will pay dividends the very first season, as the Slayden-Kirksey woolen mill will take it under its protection, and placing the goods in the hands of its drummers, deliver over its 2,000 customers as customers for the products of the new cotton mill; moreover, the woolen mill itself becomes at once a customer for cotton warp to the amount of $35,000 a year. The opinion prevails in this part of the country that "Waco is all right," and proposes to keep up with the procession, if not to lead it.

We have received the following, which explains itself: The copartnership heretofore existing between the undersigned, under the firm name of Currier & Snyder, is this day dissolved by mutual consent, Mr. T. J. Currier having disposed of his interest in the business to Mr. Snyder, who has been sole manager for the past six years. The business will be continued at same place, under firm name of J. E. Snyder. All accounts of the firm of Currier & Snyder will be paid by Mr. Snyder.

T. J. CURRIER,
J. E. SNYDER.

Believing with improved facilities both made and contemplated, I shall be better able to serve the trade than ever before, and thanking customers for past patronage, and asking for a continuance of the same so long as they are well treated, I remain

Yours truly, J. E. SNYDER.

Machinists' Supplies and Iron.

New York, March 9, 1889.

Iron—American Pig.—There is nothing in the situation calculated to inspire additional confidence, and the failure of the Reading Iron Company has had an unsettling influence. Supplies are being replenished in a very conservative manner. We quote No. 1 X Foundry, $17 to $18; No. 2 X Foundry, $16 to $17, and Grey Forge, $15 to $15.50.

Scotch Pig.—We quote Coltness, $20.50 to $21; Gartsherrie, $20; Summerlee, $20.50; Eglinton, $19 to $19.25; Dalmellington, $19.50 to $20; Clyde, $20.50 and Langloan, $20.50.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—See bottom of third column, page 11.

Situation as draftsman wanted. Technical school graduate. D. N., care American Machinist.

Wanted—A situation by a sober, reliable stationary engineer. Box 72, American Machinist.

Machine Shop Foreman wants charge. Contract if desired. Address Shop, American Machinist.

An experienced jobbing moulder desires a steady job; West preferred. 2 R., American Machinist.

Good all-around machinist, licensed engineer, wants responsible position. Smith, Am. Machinist.

Wanted—Bicycle Machinists and Assemblers. Must be first-class. The Smith Nat'l Cycle Mfg. Co., Washington, D. C.

Wanted—Young man, good engineer and draftsman, for general work and soliciting orders. Apply, Robt. Wetherill & Co., Chester, Pa.

Superintendent, foundryman and machinist, experienced in estimating and contracting, seeks reengagement; best references. Box 73, Am. Machinist.

Wanted—A first-class machinist with $2,000; must be competent to take charge of shop; a good salary will be paid to a competent man. Box 70, American Machinist.

Secretary wanted by a large, profitable Mfg. Co. in Northern Ohio. A competent man with capital; first-class references required. Address Manufacturing, Box 437, Findlay, Ohio.

First-class machinist, good draftsman, wants position in drawing office. Has designed steam engine for present employer; well up in mathematics. Address Box 75, American Machinist.

Wanted—After April 1st, position by strictly first-class mechanic as tool maker, where special machinery needs developing and constructing. Good wages required. Address Box 71, Am. Machinist.

Wanted—By competent man, position as superintendent, head draftsman or general foreman for machine shop and foundry; Washington Territory preferred; age, 40. Address Box 74, Am. Machinist.

Wanted—Experienced young mechanical engineer as asst. supt.; must be capable of making drawings. Fair compensation given for ability. State experience and references. Box 76, American Machinist.

Wanted—A first-class machinist for fine planer work; good pay and a steady job for a man faithful to the interests of his employer and capable of doing satisfactory work. Address No. 1 A B, American Machinist.

Mechanical Draftsman—Wanted, at once, a first-class man capable of designing rope hauling plant, ventilating fans and air compress'g mach'y for mining purposes. Address, with testimonials and salary required, Compressor, P. O. Box "H.," Cleveland, O.

Wanted—Situation as foreman of iron foundry; 14 years' experience in some of the best shops in the East on light and heavy work. Light, clean, smooth, intricate cored castings a specialty. Best references. Address Cast-Iron, American Machinist.

Wanted at once, a first-class man that understands running a Universal Milling Machine. A first-class lathe hand on small work; also, several good vise hands. Good wages and steady work for first-class men. Apply at once. Binghamton Hydraulic Power Co., Binghamton, N. Y.

Wanted—By a first-class machinist, position as foreman, where ability will count; experienced at heavy hydrostatic machinery, marine, stationary and blowing engines; good draftsman; can handle men to best advantage; heavy work preferred. Address Competent, American Machinist.

Wanted—A thoroughly competent and experienced workman to engage in the business of steam goods manufacture, both brass and iron. One who has served as foreman or inspector of such work would answer for the position. To the right man a good salary will be given, and chance to gain an interest. Address, stating what experience has been had in this direction, and that of managing hands, C. E. W., American Machinist.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

The Cyclone Steam Flue Cleaner is king; and has no rival. Crescent Mfg. Co., Cleveland, Ohio.

Crescent grease cup for shafting beats them all. Sample free. Crescent Mfg. Co., Cleveland, Ohio.

Wanted—Machine specialties to manufacture. Address S. Mfg. Co., care American Machinist.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State St., N. Y., Consulting Engineer. Designs of all kinds of Machinery,

Turned and Highly Polished Iron and Steel Shafting. Merwin McKaig, Cumberland, Md.

For Sale—Second-hand 72" mill for boring only; good order. A Garvin tapping machine, new. A. L. Henderer, Wilmington, Del.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

For Sale—2nd-hand engine 16x36 in., 12 foot band wheel & Judson governor, all in good repair, $300. Geo. Strecker & Co., Marietta, Ohio.

For Sale—Patent and tools for making an improved combination square bevel protractor, etc. H. W. Merrill, 135 Oliver st., Boston, Mass.

Roper's Engineer's Handy-book, the best book ever published for Engineers. Post free, $3.50. Send for list. Thos. Ordish, 1723 S. 7th st., Phila., Pa.

Wanted—Parties selling to steam users and supply houses to handle some good selling specialties on commission. Manufacturer, American Machinist.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

For Sale—One-half of the patent right under which the "Pequot" Hot-Water Boiler is mfd. This boiler has been on the market three years, and largely advertised. H. W. B., American Machinist.

Wanted—One or two first-class machinists with about $3,000, to engage with party having same amount of money, in the manufacture of Iron Planers. Only those wanted having practical experience in building these machines. None others need apply. New Design, care American Machinist.

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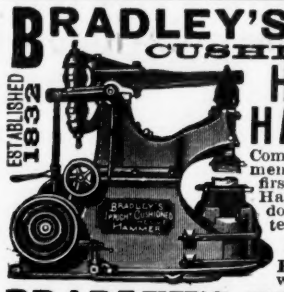

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Combines the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other Hammer in the world.

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Bridgeport Machine Tool Works,

E. P. BULLARD, Prop.

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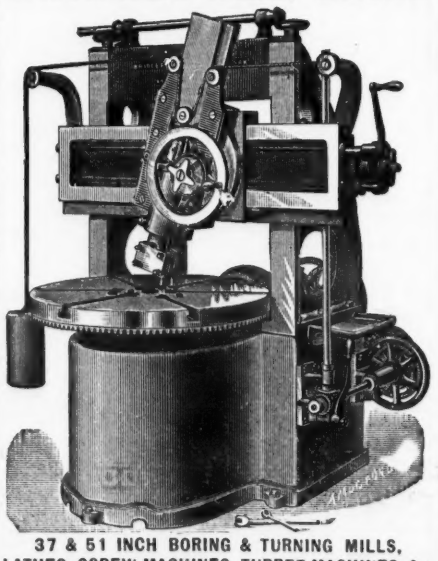
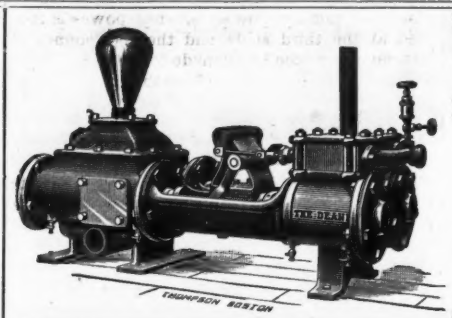


37 & 51 INCH BORING & TURNING MILLS, LATHES, SCREW MACHINES, TURRET MACHINES, &c.

PATENTS THOMAS P. SIMPSON, Washington, D. C. No atty's fee until Patent obtained. Write for Inventor's Guide.



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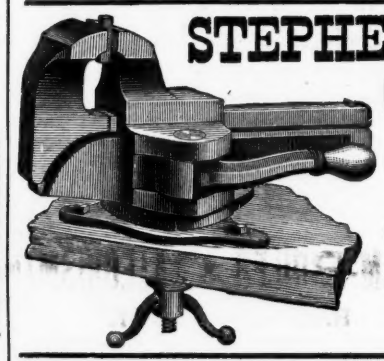

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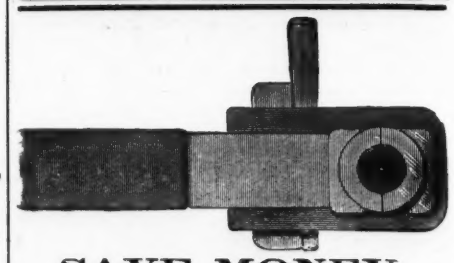

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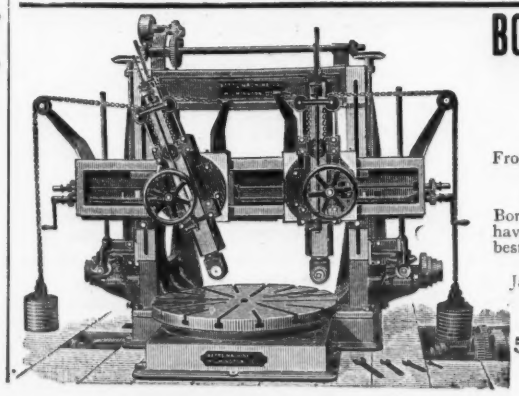

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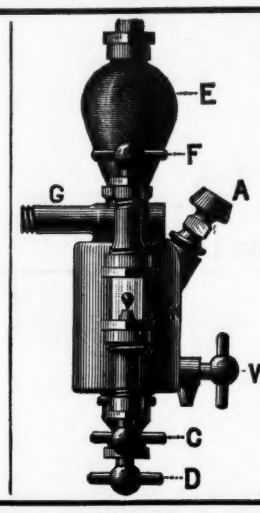

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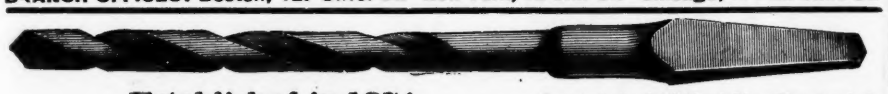

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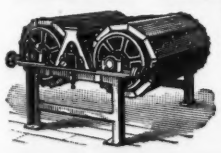

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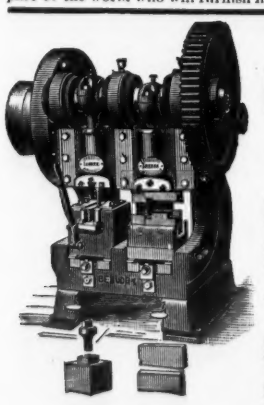

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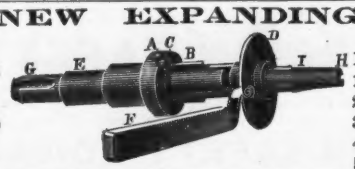

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3	1⅛ " 2 "	18
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5 " "	3 " 4 "	44

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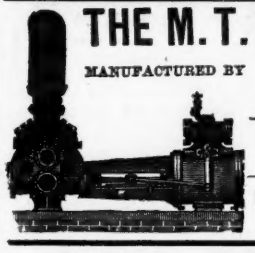

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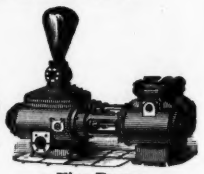

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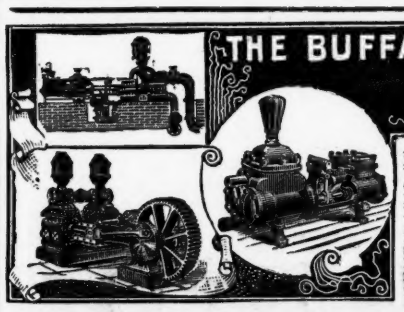

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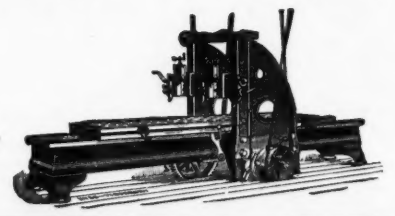

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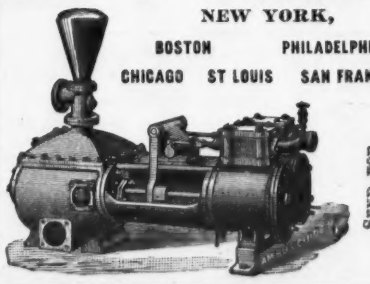

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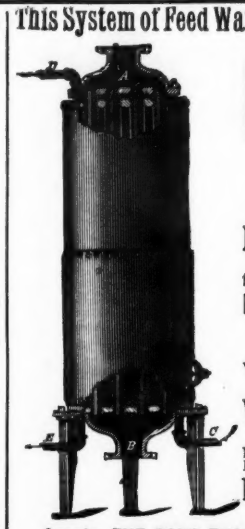

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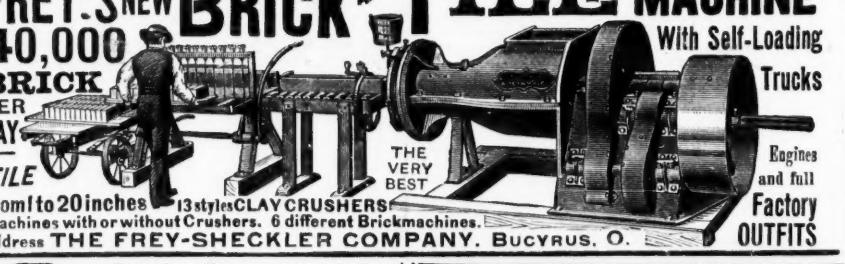

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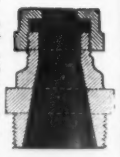

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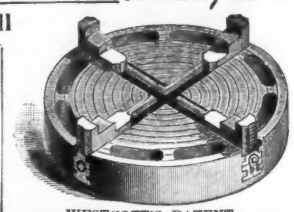

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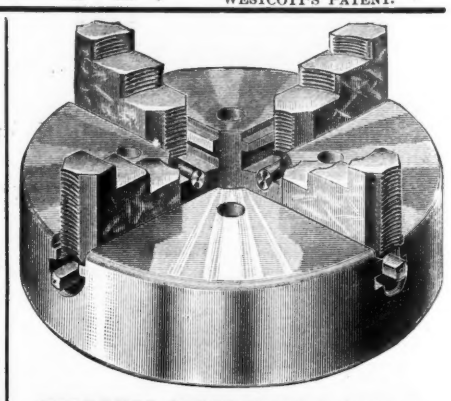

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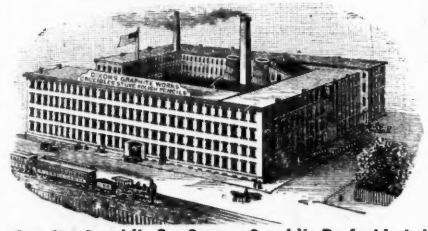

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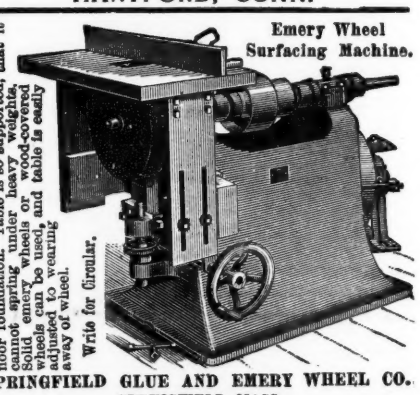

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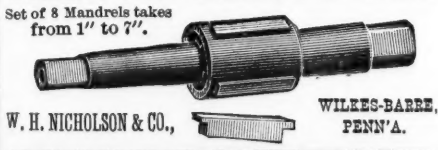

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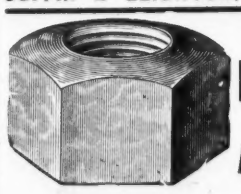

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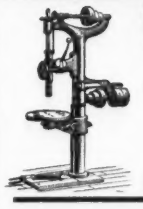

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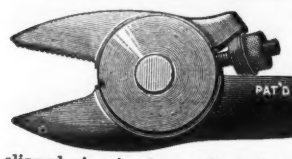

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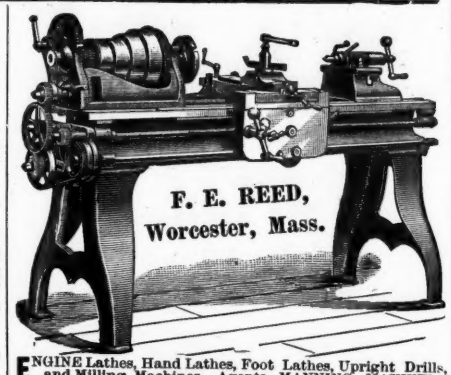

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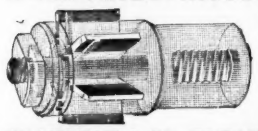

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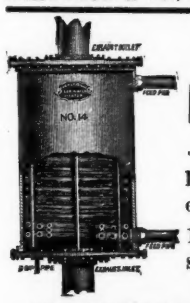

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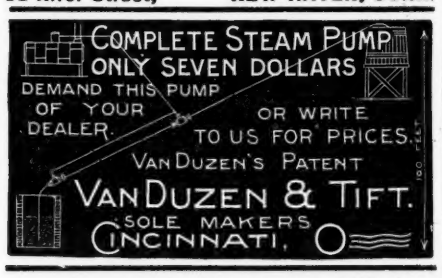

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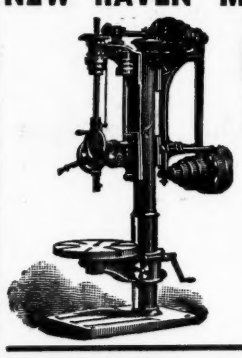

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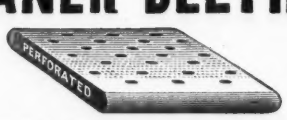

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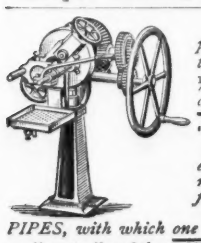

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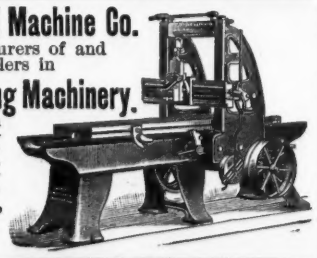

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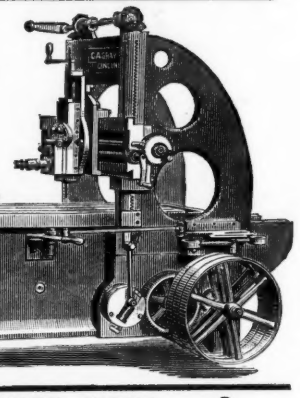

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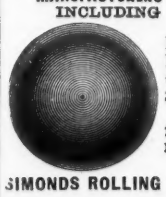

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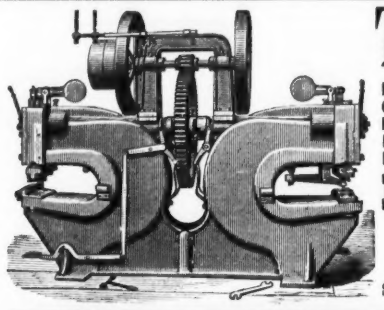

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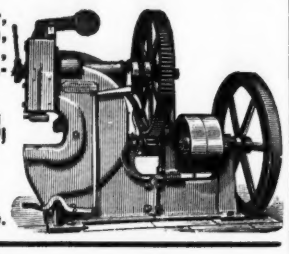

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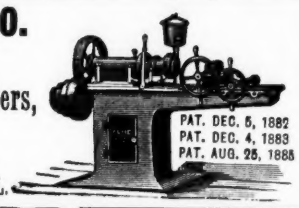

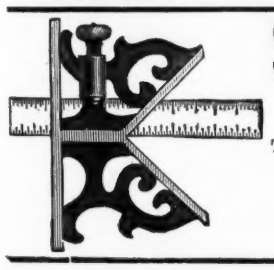

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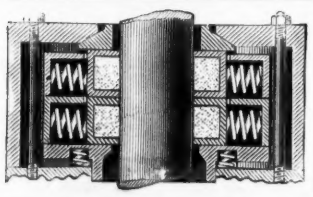

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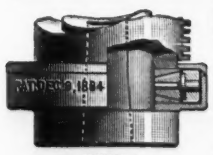

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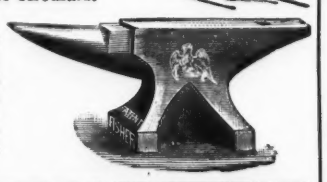

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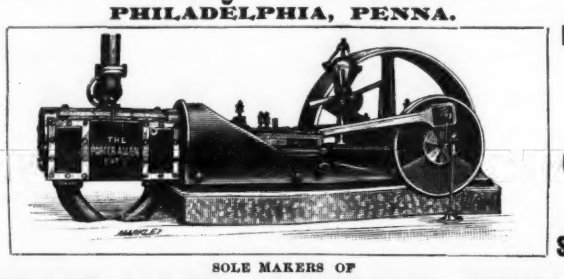

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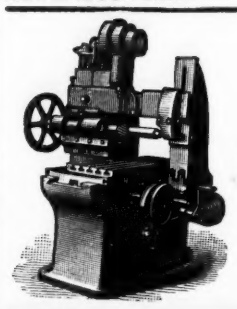

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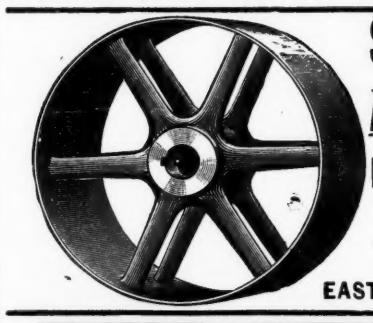

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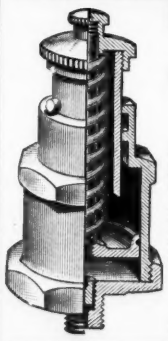

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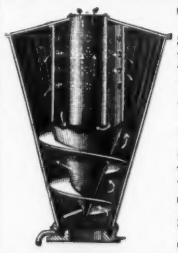

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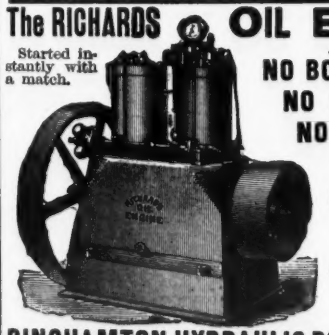

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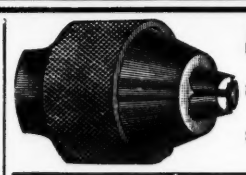

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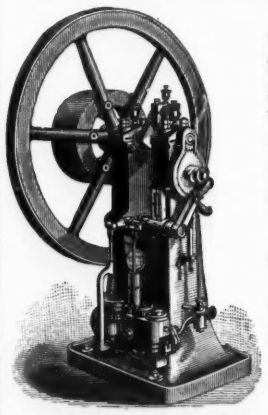

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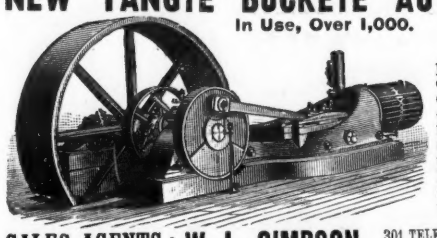

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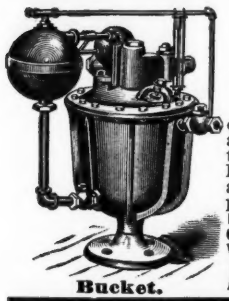

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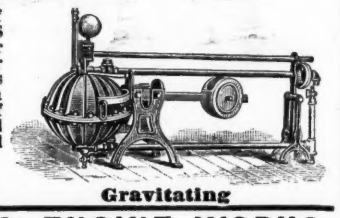

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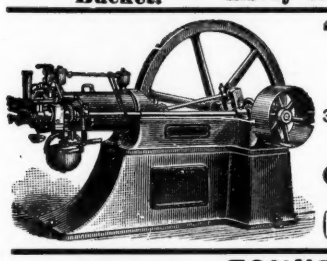

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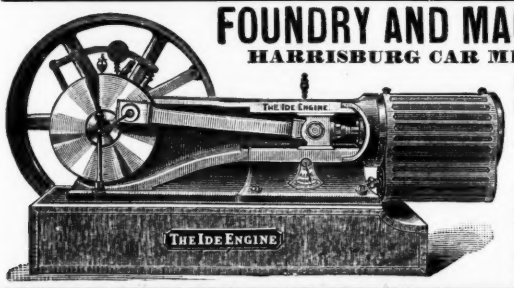

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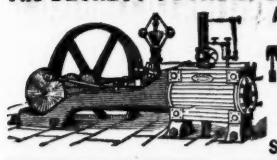

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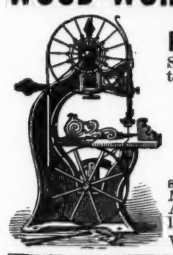

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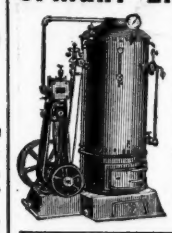

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We have opened at **23 and 25 Purchase St., Boston,** in connection with Messrs. Chandler and Farquhar of that city, a depot for the exhibition and sale of our Improved Engine Lathes, Shapers, Drill Presses and Brass Working Machine Tools, &c. We make a feature of **Complete Engine Lathes,** without charge for extra attachments.

Call and examine them. Cuts, with full descriptions, free.

LODGE, DAVIS & CO.

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WORKS, Cincinnati, Ohio.

See Advertisement, Page 16.

THE WATTS, CAMPBELL CO.

MANUFACTURERS OF IMPROVED

CORLISS STEAM ENGINES IN FULL VARIETY.

CONTRACTS TAKEN FOR COMPLETE POWER PLANTS.

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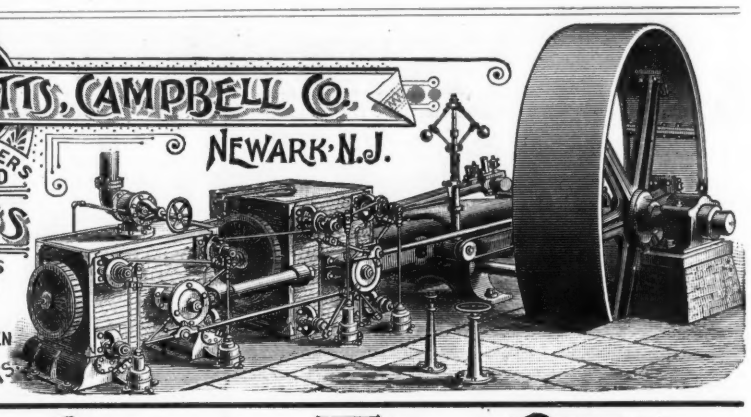
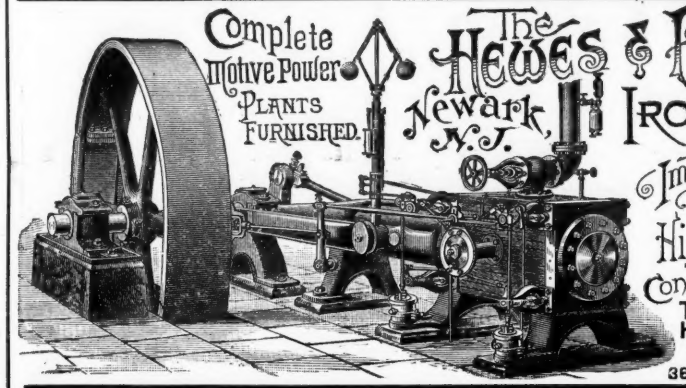


The Complete Motive Power Plants Furnished.

The HEWES & PHILLIPS IRON WORKS Newark, N.J.



Improved CORLISS ENGINES. High Pressure. Condensing and Compound

TUBULAR BOILERS.

HEAVY FLY WHEELS A SPECIALTY. IN SIZES UP TO 36 FT. DIA. BY 10 FT. FACE.

Eclipse Corliss Engine.

FRICK COMPANY, Builders, WAYNESBORO, PA.

NON-CONDENSING, CONDENSING COMPOUND. 40 TO 1,000 H.P.

Send for Circulars.

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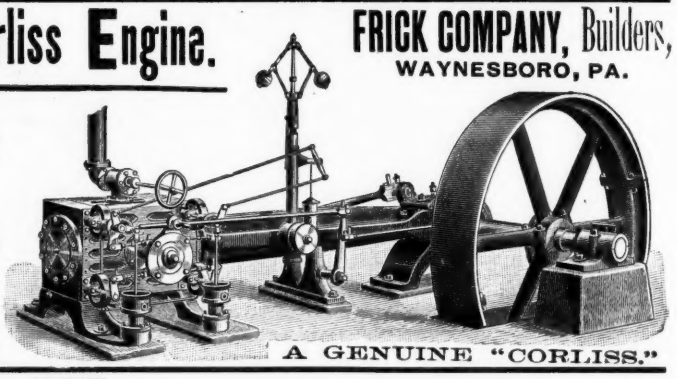

A GENUINE "CORLISS."

ROBERT WHITEHILL,

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MANUFACTURER OF IMPROVED

CORLISS ENGINES

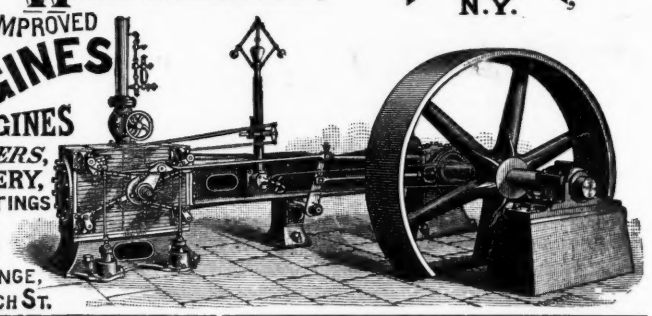
ALSO SLIDE VALVE ENGINES

STATIONARY BOILERS,

GENERAL MACHINERY,

IRON AND BRASS CASTINGS

NEW YORK OFFICE ROOM 6, COAL AND IRON EXCHANGE, COR. CORTLANDT & CHURCH ST.



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ENGINES from 15 to 400 Horse Power

Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogue.

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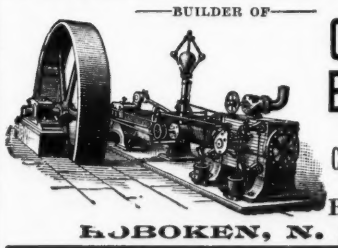

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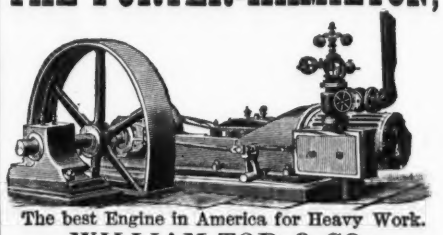
THE PORTER-HAMILTON,



The best Engine in America for Heavy Work.

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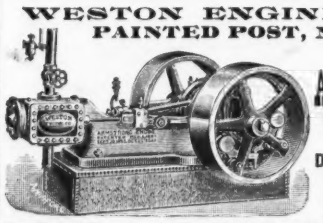

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CORRECT IN Design, Workmanship and Price.

5 to 75 H. P.

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Friction Pulleys, Clutches and Elevators,

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IRON AND BRASS WORKING MACHINERY.

Illustrated in our 1888 Catalogue.

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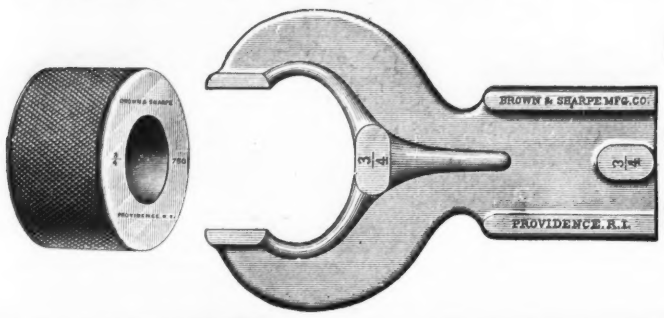
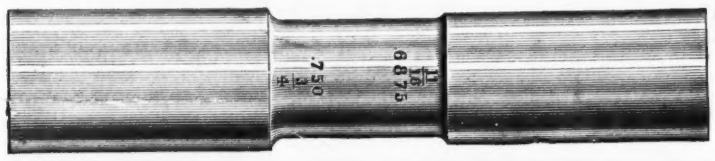
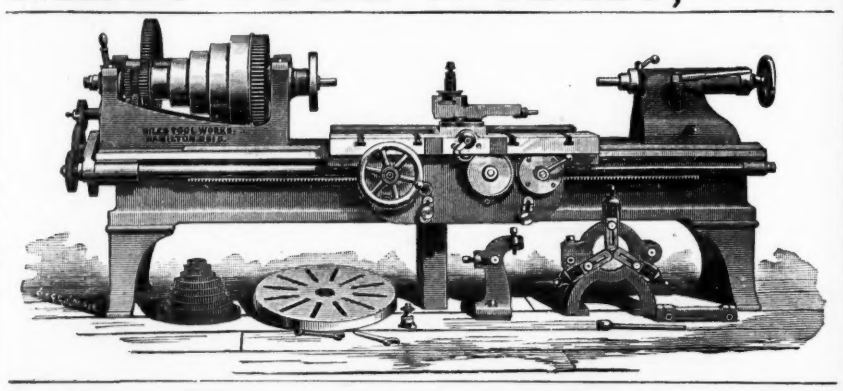


Standard Caliper Gauges.



Standard Cylindrical Gauges.

NILES TOOL WORKS, HAMILTON, OHIO.



Lathes, Planers, Shapers, Slotters, Etc.

GRANES

THE YALE & TOWNE MFG CO.
STAMFORD CONN
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JENKINS BROS. PUMP VALVES.

We make a specialty of Hard Rubber Pump Valves for Hot Water, Oils and Acids, also for very high pressures.

Accept no Pump Valves as JENKINS or JENKINS BROS., unless stamped like cut.

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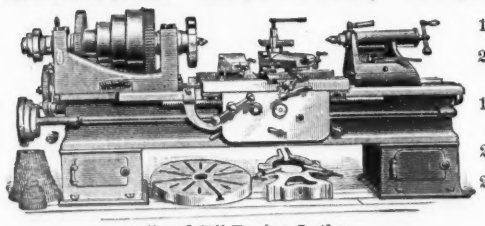
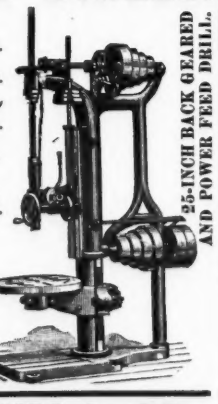
ENGINE LATHES, SHAPERS & DRILLS.



24″ and 27″ Engine Lathe.

15″ and 20″ Crank Shapers.
20″ 26″ and 32″ Geared Shapers.
17″ 19″ 21″ 24″ 27″ and 38″ Engine Lathes.
20″ 24″ Upright Drills.
25″ 28″ 32″ 40″ B. G. P. F. Drills.



25-INCH BACK GEARED AND POWER FEED DRILL.

LODGE, DAVIS & CO.,

CINCINNATI, OHIO.

SEND FOR PRICES. IT WILL PAY YOU.

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GOULD & EBERHARDT,

Near Market St. Depot,
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Pat. Shapers.
NEARLY
1,500
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EBERHARDT'S
Patent
GEAR CUTTER.

In Use throughout the World.

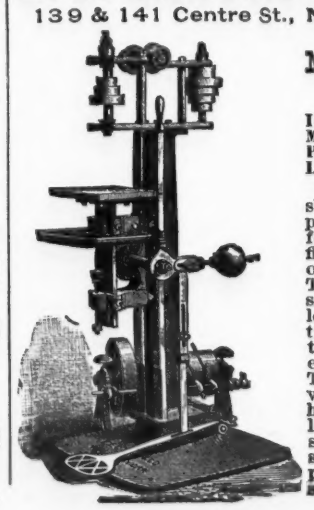
GEAR AND RACK CUTTING TO ORDER.

E. E. GARVIN & CO.,

139 & 141 Centre St., New York,

Manufacturers of
Machinists' Tools,

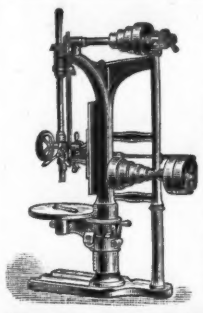
Including Milling Machines, Drill Presses, Hand Lathes, &c.



The machine shown in cut is especially designed for jobbing, and is fitted up with one or two spindles. Those with two spindles have pulley, with two sections, which gives two speeds to each spindle. Those fitted up with one spindle have a cone pulley with three sizes. The back shaft has a cone pulley with four sizes.

THE PRATT & WHITNEY CO.,

Hartford, Conn.,



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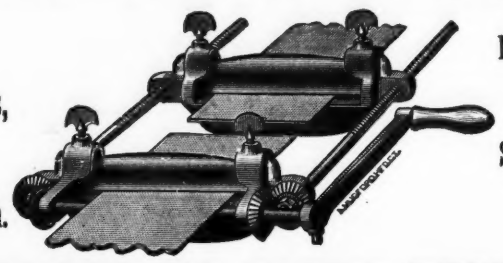
Renshaw's Ratchet Drills, Nos. 1 and 3; **Upright Self-Feeding Hand Drilling Machines** for Blacksmiths; **Upright Drilling Machines,** single and multi-spindle, both those in which the spindles are without feed movement and tables are operated by hand or foot lever, and those in which the tables have provision for adjustment, and spindles are fed by hand lever, or by hand wheel, or automatically; also, **Horizontal Drilling Machines,** single and multi-spindle.

WESTERN BRANCH, 100 West Washington St., Chicago. Ills.

THE BILLINGS & SPENCER CO., Hartford, Conn.

Belt Clamps, IN Eight Sizes, FROM Eight Inch TO Thirty-six Inch.



Machinists' Tools, Sewing Machine Shuttles AND Bobbins.

DROP-FORGINGS OF EVERY DESCRIPTION.
SEND FOR CIRCULAR.

WARNER & SWASEY, CLEVELAND, OHIO.

GLOBE VALVE CHUCK.
BRASS WORKING MACHINERY
ILLUSTRATED CATALOGUE ON APPLICATION.

GEO. W. FIFIELD,

Manufacturer of ENGINE LATHES from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application.
Lowell, Mass., U. S. A.

Gear Wheels and Gear Cutting.—I make g to order, or cut teeth on g blanks sent to me. Of all kinds. Of all sizes to six ft. dm. Small orders or large ones. Fine g or cheap g. Small cast g. Ready made brass g by mail at low prices. Revel g with perfect planed teeth. Hand Book on g, $1. Facilities complete. Terms reasonable. Send for cat.
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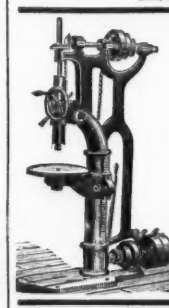

Key-Seating Machines and 20 in. Drills

A SPECIALTY.
SEND FOR LIST OF
New and Second-Hand
Lathes, Planers, Drills, or anything in Machinists' Tools or Supplies.

W. P. DAVIS,
Rochester, N. Y
Works at North Bloomfield.

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THE POND MACHINE TOOL COMPANY,

Formerly of Worcester, Mass.

The new shops of this company are located at Plainfield, N. J., forty minutes' ride from New York city on the line of the Central Railroad of N. J., and consist of the following:

A machine shop 500′ long by 100′ wide; a foundry 250′ long by 90′ wide; also commodious buildings for the storage of sand, coal, coke and pig iron; ample and convenient wash rooms for the men; fireproof two story pattern storage; blacksmith shop; engine and boiler houses. These buildings are detached from the machine shop and foundry. There is an elevated railroad for the convenient distribution of raw materials, and a railroad running through the machine shop for shipping. The whole plant is supplied with the incandescent system of electric lighting.

The machine shop and foundry have overhead traveling cranes running through their entire lengths; also light traveling cranes, which serve every tool, and a number of jib cranes in the foundry and scratch rooms. The foundry has capacity for making the heaviest class of castings.

All our tools are expressly designed for the economical manufacture of heavy machinery for railroad and general machine shop equipment, from new patterns of the latest and best designs.

SALESROOM and OFFICE, 111 & 113 Liberty St., N. Y. City.
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Fine Machinists' Tools.—E. Boston, Mass—Send for Circular

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THE G. A. GRAY CO.,
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See advertisement, page 13.

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PRATT & LETCHWORTH,
PROPRIETORS
BUFFALO STEEL FOUNDRY,
BUFFALO, N. Y.

The STILES PATENT DROP HAMMER,

Manufactured by
THE STILES & PARKER PRESS CO.,
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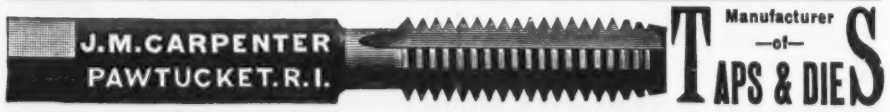
ALSO MAKERS OF
PUNCHING STAMPING DRAWING **PRESSES** and DIES.
Branch Office and Factory, 203, 205 & 207 CENTRE ST.,
200 p. Catalogue on application. NEW YORK CITY.



Manufacturer —of— TAPS & DIES